AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 5, No. 46. WEEKLY. | NEW YORK, NOVEMBER 18, 1882. | $3.00 per Annum. SINGLE COPIES, 6 CENTS.

COPYRIGHT, 1882, BY AMERICAN MACHINIST PUBLISHING COMPANY.

For Sale Everywhere by Newsdealers.

ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

Improved Otto Gas Engine.

Since the gas engine was first invented and its practicability fully demonstrated, large numbers of them have been put into practical use in localities where other engines could not be operated to any degree of advantage.

The Otto gas engine, as made by Schleicher, Schumm & Co., 33d and Walnut streets, Philadelphia, Pa., was described in the AMERICAN MACHINIST of August 16, 1879. Since that time this engine has been improved somewhat by the arrangement of details, although the general principles remain the same. The engine shown in the accompanying engraving represents one of a single horse power.

This size was constructed to satisfy the requirements of jewelers, job printers, grocers and amateurs, who wanted a cheaper and smaller power than any previously made by the builders. The bedplate is a single casting of symmetrical form. In this engine the governor and valve gears are placed upon the left side of the cylinder instead of upon the right, as in the older styles of this engine.

The governor is so arranged that it entirely cuts off the gas when the maximum speed is exceeded, as when the load is suddenly thrown off the engine.

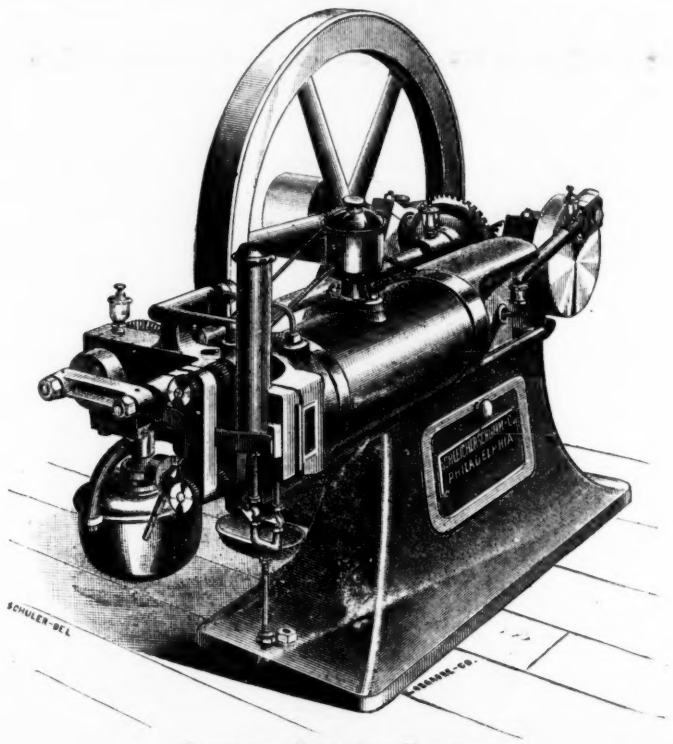
The cylinder is 4″ in diameter with 8″ stroke, and has a water jacket in which cold water circulates the same as formerly. Instead of the double crank, a disc is used, while the rod, crosshead and connections are made in the usual way. Upon the middle of the cylinder is an oil cup from which oil is fed automatically, drop by drop, to each end of the cylinder. Within the oil cup is a shaft from which is pivoted two small arms. As the shaft is rotated by a belt, these arms are lowered into the oil, and taking up a drop of oil each, they deposit the lubricant in the funnel-shaped mouths of two pipes which convey it to the cylinder. This engine is intended to run 180 revolutions per minute, developing 1¼ indicated horse power. The floor space occupied is 3 ft. × 6 ft., and the weight is 1200 lbs.

The light weight and compact form of this engine permits quick and easy transportation, and after reaching its destination it may be quickly started.

The gas consumption, as in the larger sizes, is in proportion to the power used. This engine will use from 11 cubic feet to 33 cubic feet of gas per hour, which, at $2 per thousand feet, would cost from 2 cents to 6½ cents per hour. The insurance is not affected in the least by the introduction of one of these engines into a building, as they are not accompanied with the slightest danger of an explosion.

In a test in this city of several of these engines of 2, 7 and 10 horse power, the average cost of gas per indicated horse power per hour was 1.9 cents. Since it first came out, the Otto gas engine has grown in favor to such an extent that there are now over 8,000 of them in use. They are made in sizes from one up to twenty-five horse power in this country, and in Europe from one-half up to fifty horse power.

The indicator diagrams taken from these engines, by which their power is determined, very much resemble those taken from a steam engine having a most economical throttling governor. In some of the diagrams taken from a 6¾″ × 12″ cylinder at a speed of 170 revolutions per minute, the initial pressure, or pressure at the commencement of the stroke, was 155 lbs., from which it fell away in a very economical expansion curve, showing a free release at the end of the stroke. The explosive mixture used in the cylinder is composed of about one part of illuminating gas to twelve of air, depending upon the quality of the gas. These engines are largely used to run elevators, and in fact wherever light power is required.



IMPROVED OTTO GAS ENGINE.

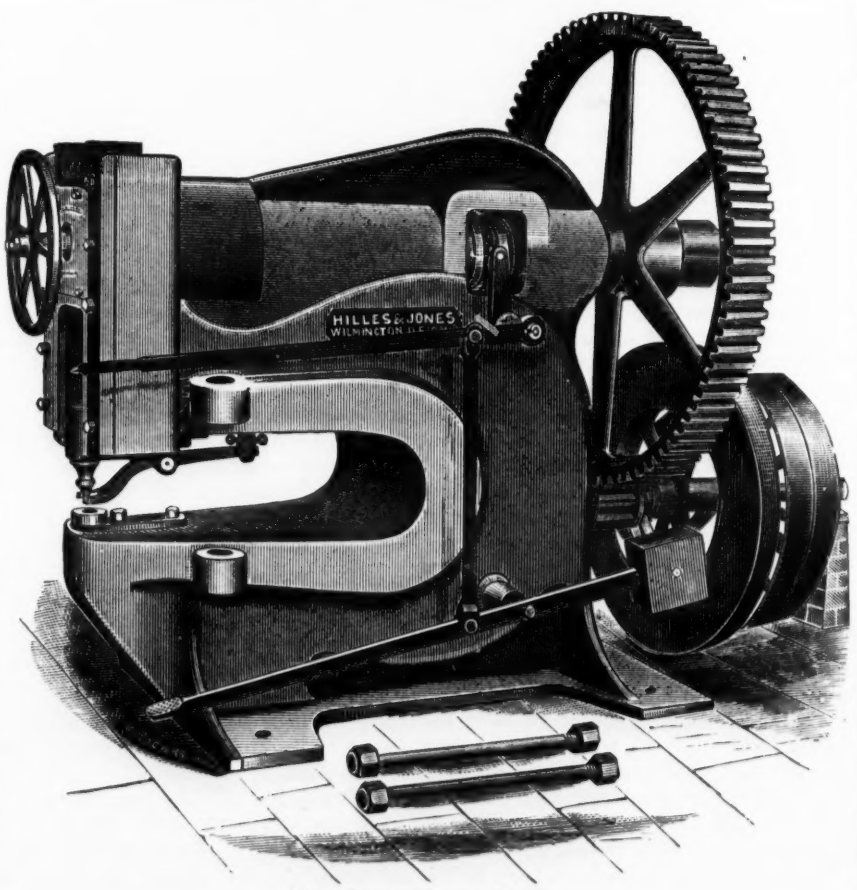
New Boiler Shop Punch.

We present with this an engraving representing the new heavy boiler shop punch, made by Hilles & Jones, Wilmington, Del. This punch is designed for a great variety of work, the throat or reach being 42″, and the strength and power sufficient to punch holes 2″ in diameter, 42″ from the edge of the sheet, and through 1″ iron.

The stripper, as will be seen from the engraving, is so arranged as to be almost instantly adjusted for any thickness of iron, thereby facilitating changes from one thickness to another. The dies and punches are also readily changed and adjusted, and are located so that flanged heads and angle iron can be punched.

The large driving gear is situated close to the journal (the clutch being on the outside of the gear), so that the effect of overhang is reduced to a minimum. The clutch is operated, by means of the lever shown, through a rod extending in a central hole in the shaft from the sleeve to the outside of the driving gear.

The hand-wheel shown, over the die, is used for the purpose of bringing the punch down to the work before throwing in the clutch, when very accurate work is required.



NEW BOILER SHOP PUNCH.

Accident Upon a Locomotive.

On Oct. 22, what came near being a very serious accident occurred upon the locomotive of a passenger train on the Pennsylvania Railroad, between Jersey City and Newark. The Ashton blowback safety valve has been applied to a number of the locomotives on this road, but instead of blowing the steam from the safety valve into the tender and heating the water, a pipe conveys the escaping steam to the smokestack, where it passes off with very little noise. The engine drawing the train alluded to had just come out of the shop, this being the first trip. When the safety valve lifted the steam blew into the furnace where it become super-heated, forming an explosive mixture which ignited, and bursting through the open furnace door set fire to the engineer's clothing and the cab. The fireman had great difficuly in bringing the train to a stop. The probability is that while the engine was in the shop the mouth of the pipe was turned so that the steam, instead of blowing up the stack was directed back through the tubes to the fire-box, otherwise it would be difficult to conceive how the steam could be blown back through the tubes.

A reader, who evidently misunderstands the scope of the AMERICAN MACHINIST, writes: "Permit me to suggest placing the advertisements on separate pages, so as to avoid binding them in the volume. I desire to get my numbers bound, and presume most of your readers do likewise."

The difficulty or inconvenience our reader refers to exists only in the imagination. A cloth bound volume of the AMERICAN MACHINIST (52 numbers) makes a book only one and a half inches thick, and by no means cumbersome to handle. Were all the advertising pages stripped off, and the book reduced to an inch in thickness, it would make very little appreciable difference in convenience of using. On the other hand, there are excellent reasons for binding and preserving the advertisements. They constitute alone a valuable record of current mechanical progress. They all relate directly to the machine shop, and very little of the space they occupy is devoted to announcements of a transient nature. If a representative journal of the machinery interests (such as the AMERICAN MACHINIST now is) had been published in this country twenty years ago, a file of the advertisements covering a year's publication would be examined with more interest at this time than the reading matter for the

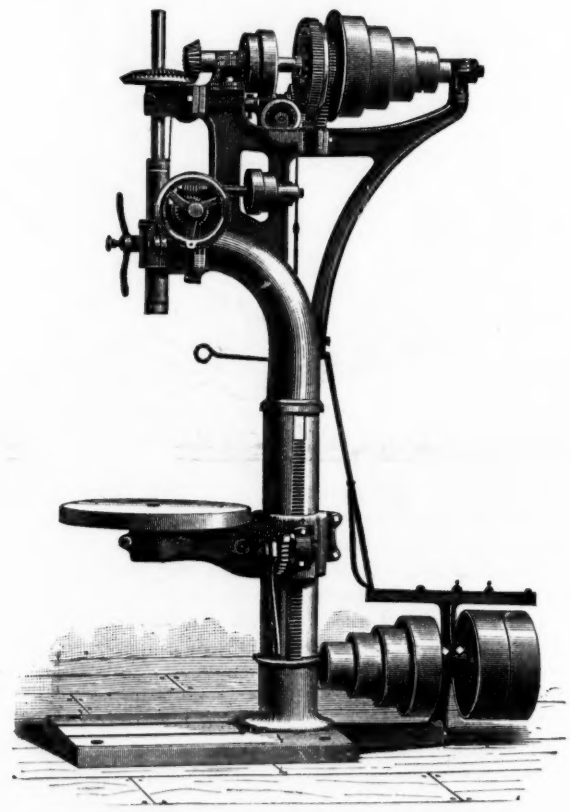
same period. The advertisements of the AMERICAN MACHINIST are a part of the journal we publish, and cannot consistently be separated from the other part.

Improved Vertical Drilling Machine.

The drill press shown in the engraving presented herewith is being manufactured by H. Thompson, 22 Cypress street, Worcester, Mass. It consists mainly of a goose-neck column of unusual thickness, with a brace at the back to support the cone shaft and back gear. The cones have four diameters, as shown, the smallest diameter being 5″ and the largest 11″. The head is fixed as seen in the engraving, the spindle having a vertical movement of 10″. The feed wheel is conveniently located at the right of the workman, as he stands in front of the machine. On the left-hand end of the feed wheel shaft is a worm, which meshes into a worm wheel mounted on a shaft below, at right angles to the former shaft. This worm and gear are encased to protect them from dirt. An oil box is formed in the bottom of this case, to lubricate the parts.

A hand lever is attached to the outer end of the latter shaft, for operating the quick return motion. To use the quick return motion, the worm gear is not, as in some other drill presses, thrown out of gear with the worm, but the worm wheel is thrown in and out of gear with the worm gear shaft by means of a clutch. This clutch is operated by a knob, attached to a rod extending through the shaft. To connect the worm gear with the shaft, the knob is drawn out; to disconnect the same, the knob is pressed in. In the latter case, the worm wheel shaft and the pinion for raising and lowering the spindle are left free to be operated by the quick return lever, without rotating the worm gear. This mechanism is very convenient and expeditious, and may be easily operated by the same hand that moves the lever. This machine also has an automatic feed, driven by a belt upon a cone on the upper cone shaft. This feed consists of a worm gear placed upon the hand wheel shaft, as shown.

The worm wheel is either engaged or disengaged with the shaft, as desired, by an internal clutch, operated by pulling or pushing upon a knob at the center of the hand-wheel. The spindle is counterbalanced by a weight within the column, while the hole is bored to fit the larger sizes of Morse twist drills. The table is elevated and lowered 25″ by a rack, pinion and ratchet, as shown; this mechanism being conveniently located at the right side instead of at the back of the machine as in ordinary drill presses. The table may also be swung around the column to any desired position. The base is uncommonly large, for drilling large pieces of work. The driving pulleys are 12″ in diameter and have 3¼″ faces, and should run at a speed of 250 revolutions per minute. When so desired, the back brace is extended to the base, forming a double column. Distance from column to center of table, 25″. From spindle to base, 48″. The weight of the machine here shown is about 1,000 pounds. When made plain, without back gear and automatic feed, the weight is about 875 pounds.



IMPROVED VERTICAL DRILLING MACHINE.

Artificial Fuel and Its Manufacture.

More than 30 per cent. of the product of the anthracite coal regions of Pennsylvania is said to be unmerchantable dust. Efforts in the past have not been wanting to utilize this fuel, but hitherto the problem has been one that defied practical solution. Recently an English engineer, W. H. Cory, has been establishing in this country his plants for manufacturing artificial fuel from this dust, and we understand is meeting with very gratifying success. To explain some of the difficulties that have previously neutralized efforts in this direction, we quote from an article by Mr. Cory, as follows:

"In considering the manufacture of artificial fuel, it will be first necessary to show why any difficulty has ever arisen in converting small coal into fuel by any of the processes now known. This is done in few words. For such coals as are non-caking or non-coking, such as anthracite, lignite, and the like, it is impossible to bind them with any of the bituminous fuel processes, for this reason: Owing to the quick combustion of pitch and like substances, the pitch is soon consumed in the furnace or stove, and, as such coals will not coke or bind themselves together, immediately the pitch is consumed the coal assumes its former condition of dust, and thus makes the manufacture into fuel a useless operation.

"Again: Without great precautions—such as leaving the furnace door open (which would naturally damp down the boiler), absence of stoking, and other necessary measures—the pitch would melt, even with the coking coal, and run through the fire bars. Added to these great objections, are the smoke and smell given off by the pitch, which would, in the case of steam furnaces, block the tubes and flues with soot, while the smell of the pitch alone would be sufficient to prevent it being used for domestic purposes.

Mr. Cory's method "consists of first mixing the slack coal with a small percentage of fine dry fire-clay, and adding another small percentage of silicate of soda, or silicate of potash in solution. The three materials are thoroughly mixed, and submitted to a pressure of one ton to the square inch of the block surface. The blocks so made are stacked in a shed, like ordinary bricks, to dry, care being taken to admit a small current of air between them, and within 24 hours (without heat of any description during the whole process) are as hard as ordinary lump coal.

"In compounding bituminous slack, the percentage of chemical required would be 2 per cent. of fire-clay and 3 per cent. of silicate, at a specific gravity of 1.3, while for non-coking coal the percentage would be slightly higher, as the chemicals have to hold the particles of coal together, unaided, during the entire operation of combustion.

"The blocks of fuel, on coming from the press, are sufficiently hard to admit of being freely handled, and during the 24 hours set aside for them to dry the chemical action of the fire-clay upon the silicate takes place, converting it into silicate of alumina, which not only forms a most powerful binder, but vitrifies the block, is insoluble, and only fuses at the very highest furnace heats, thus not only making the block very hard, but accounting for blocks so made being weather-proof, and also for the absence of clinker."

The advantages are summed up as follows:

"1. Cheapness of manufacture.

"2. The fuel is generally better than lump coal, and will do at least *seven per cent.* more work, as the fuel is all burned, while in coal much of it is wasted by the small coal falling through the fire-bars, etc.

"3. The simplicity and quickness of manufacture.

"4. The process is a cold one, and consequently there is an enormous saving of labor, material, and expense, as compared with the pitch processes, in which the coal and pitch have to be heated.

"5. The silicate is cheap, and may be easily and cheaply manufactured, and fire-clay can be had wherever coal is attainable.

"6. Its facility for stowage, cleanliness, hardness, and portability.

"7. The fuel being compressed, only occupies thirty cubic feet per ton, whereas coal takes forty-two.

"8. It does not foul the flues.

"9. No chemicals are used which can have a detrimental effect upon the coal, or cause clinkers, for silicate of alumina only fuses at the very highest furnace heats.

"10. No sulphur, pitch, animal, vegetable, or odorous matter is used.

"11. The fuel does not injure the fire-bars, block up the boiler-tubes, create disagreeable smell, or decrepitate in the furnace, and is much easier to stoke than ordinary coal.

"12. The chemicals are quite smokeless, and while being suitable for the agglomeration of all descriptions of slack coal, are especially adapted to the manufacture of culm, lignite, and non-coking coals—*it being the only process known that will effectually hold these descriptions of coals together during combustion.*

"13. The fuel is not affected by heat or moisture, nor is it liable to spontaneous combustion, which is the case with pitch fuels.

"14. It is equally adaptable to all the purposes to which lump coal is applied, and in England commanded from 1s. (22 cents) to 1s. 6d. (33 cents) per ton above the price of large coal of the same description.

"15. No instructions are required as to its burning, it being used in every respect the same as large coal.

The works required in the manufacture of this fuel are simple. For making 240 tons per day, the machinery is run by a 35 horse-power engine. The press, which is the most important feature, is provided with a revolving table having six molds each 6 x 9 inches, with rounded corners, the arrangement being such that during the revolution the molds are successively filled with the mixture, the mixture subjected to the pressure determined upon, and the compressed blocks delivered to an endless band and carried to the stacking shed to be dried.

The cost of manufacturing 240 tons of fuel, allowing 20 per cent. for wear and depreciation of machinery, is given at $120, or fifty cents per ton.

Mr. Cory, although he only commenced the introduction of his invention a few months since, has already introduced five sets of his machinery.

Report of the Tariff Commission.

It is understood that the active work of the Tariff Commission, in the matter of taking testimony, has closed, and that its report to Congress is now under consideration. Not being a regularly constituted committee of Congress, the Commission, as a merely advisory body, composed of private individuals, has labored, from the start, under the disadvantage of acting without recognized authority, and its sessions have failed to command the full measure of public attention and respect which the importance of the subject demanded. Not only this, but the Commission has been assailed in many influential quarters, as being mainly made up of individuals representing and identified with heavily-protected industries, who should have appeared before a properly constituted body as advocates, instead of being allowed to sit as judges. By others, the very establishment of a Commission has been denounced as a trick, intended to prevent or postpone tariff revision.

The existing situation, therefore, being as it is, and the revision now going on having been entered upon mainly through the efforts of the protectionists themselves, however these matters may be viewed, the friends of protection should take several things into candid account at this time.

One is, that the anomalies and abuses which have existed in the tariff, and which it is the Tariff Commission's object to point out, have been commented upon to the disadvantage of protection, and wide-spread uneasiness has resulted. Another is, that many persons who ordinarily believe in protection are inclined to think, with reference to a large number of the protected industries, that they have been "protected enough," and that protection in their cases should cease. Still another is, that cheaper processes and changed conditions have so far lessened the cost of producing many (and some very important) articles of manufacture, that a rate of duty which was fair at the time it was originally fixed, has become oppressive at the present time. A further consideration is that, heretofore, too much of our tariff legislation in Congress has been the result of log-rolling and combined effort on the part of legislators personally identified with favored industries and not greatly concerned regarding the welfare of labor; in other words, that the interests of the whole people have been considered in such legislation very little, or not at all.

Now, in view of the foregoing considerations, and especially in view of the fact that stability is the one thing which the tariff needs, almost before all others, the real friends of protection should unite in demanding that whatever action is taken upon the tariff should be substantial and not trifling. Mere smoothing of rough corners will not answer, because it would not be generally accepted, and its ultimate tendency would be to cause the fate of protection to be decided, not by its friends, but by its enemies. Readjustment, whether in the direction of higher or lower duties, while thorough and substantial, and having its limits clearly fixed in advance, should be made gradual in operation, avoiding violent shock to existing interests.

The tariff should take the general good into account rather than the wishes of influential individuals. It should be based upon the principle of the better and more remunerative employment of American labor, rather than upon merely multiplying the profits of manufacturers.

Briefly stated, the tariff should be made *stable*, by making it *just*. Duties should be

made easy of collection, by making them simple. The enemies of protection should be silenced, by taking away all reasonable grounds for complaint and reducing their number down to the little knot of theorists and importers who favor absolute free trade and direct federal taxation.

Recommending these things, the Tariff Commission will at once rebuke its critics and justify its existence. Enacting these things, Congress will vindicate its action hitherto, while assuring the future of protection.

Annual Meeting of the American Society of Mechanical Engineers.

The annual meeting of the Mechanical Engineers was held in the Turf Club Theatre, New York, November 2d and 3d. About 75 members were present. The President stated that the membership had increased during the year just closed from 297 to 354, including the following list elected at this meeting:

HONORARY MEMBERS.

DANIEL K. CLARK. M. I. C. E., London, England.
RUDOLPH CLAUSIUS, Bonn, Prussia.
PETER COOPER, D. C. L., New York City.
O. HALLAUER, Soc. Ing. Civils de France, Munster, Alsace.
G. A. HIRN, Correspondant de l'Institut de France, Associé des Académies de Belgique, de Suede, &c., &c., Colmar, Alsace.
FRANCIS REULEAUX, Berlin, Prussia.
SIR EDWIN J. REED, K. C. B., M. P., London, England.
HENRI SCHNEIDER, Le Creousot, France.
C. WILLIAM SIEMENS, D. C. L., F. R. S., &c., London, England.
HENRI TRESCA, Membre de l'Institut. President Honoraire de la Société des Ingenieurs Civils, Paris, France.

PROMOTIONS.

WILLIAM K. SEAMAN, Associate A. S. M. E., Scranton, Pa.
CHARLES C. WORTHINGTON, Associate A. S. M. E., New York City.

MEMBERS.

WILLIAM J. BALDWIN, Supt'g Engineer Nason M'f'g Co., 71 Beekman Street, New York City.
THEODORE BERGNER, 424 Walnut Street, Philadelphia, Pa.
M. C. BULLOCK, 86 Market Street, Chicago, Ill.
THEODORE COOPER, 35 Broadway, New York City.
S. ASHTON HAND, Toughkenamon, Chester Co., Pa.
CHARLES KIRCHHOFF, 27 Park Place, New York City.
GAETANO LANZA, Mass. Institute of Technology, Boston, Mass.
JOHN W. MOORE, Chief Engineer, U. S. N., Champlain, Clinton Co., N. Y.
EDWARD S. RENWICK, 19 Park Place, New York City.
COLEMAN SELLERS, JR., 332 N. 33d Street, Philadelphia, Pa.
HENRY R. TOWNE, Stamford, Conn.
DAVID TOWNSEND, Bush Hill Iron Works, Philadelphia, Pa.
PROF. JOHN BURKITT WEBB, Ithaca, N. Y.
B. H. BARTOL, 1,903 Spruce Street, Philadelphia, Pa.
HENRY LEON BINSSE, 40 W. 19th Street, New York City.
H. M. BYLLESBY, 65 Fifth Avenue, New York City.
JOHN W. CARRINGTON, 579 Classon Avenue, Brooklyn, N. Y.
CHARLES L. CLARKE, 65 Fifth Avenue, New York City.
VINCENT G. HAZARD, The Pusey & Jones Co., Wilmington, Del.
WILLIAM F. MATTES, Scranton, Pa.
THOMAS R. MORGAN, Alliance, Ohio.
HENRY G. MORRIS, Philadelphia, Pa.
A. J. PITKIN, Schenectady Locomotive Works, Schenectady, N. Y.
STEPHEN NICHOLSON, Providence, R. I.
WILLIAM H. PATTON, Virginia City, Nev.
IRVING M. SCOTT, San Francisco, Cal.
EDWIN WESTON, Newark, N. J,
JOHN R. ABBE, Manchester, N. H.
MOSES G. FARMER, Newport, R. I.
CHARLES C. ABBE, South Windham, Conn.
GEORGE W. BIGELOW, New Haven, Conn.
WILMER G. CARTWRIGHT, Stevens' Institute, Hoboken, N. J.
J. H. MCEWEN, Supt. McEwen Bros. Mach. and Eng. Works, Wellsville, N. Y.
F. A. Halsey, 249 Broadway, New York.
WILLIAM LEONARD NICOLL, Navy Department, Washington, D. C.
JOHN WALKER, Walker Manufacturing Co., Cleveland, Ohio.
WM. C. WILLIAMSON, Philadelphia, Pa.

ASSOCIATE.

A. ALLER, 109 Liberty Street, New York.

JUNIOR.

SAMUEL HIGGINS, Susquehanna, Pa.

OFFICERS ELECTED.

President.
E. D. LEAVITT, JR.
Vice Presidents.
JOHN FRITZ,
HENRY MORTON,
WILLIAM METCALF.
Managers.
ROBERT W. HUNT,
CHARLES T. PORTER,
C. J. H. WOODBURY.
Treasurer.
CHARLES W. COPELAND.

The following change in the rules was presented and adopted without discussion, Article XL. to read:

"The society shall claim no exclusive copyright in papers read at the meetings, nor in reports of discussions, except in the matter of official publication, with the society's imprint, as its transactions. The secretary shall have sole possession of papers between the time of their acceptance by the council and their reading, together with the drawings illustrating the same and at the time of such reading, or as soon thereafter as practicable, he shall have printed copies of such papers, "subject to revision," with such illustrations as are needed for the transactions, for distribution to the members, and for the use of technical newspapers, American and foreign, which may desire to reprint them in whole or in part. The policy of the society in this matter shall be to give papers read before it the widest currency possible, with a view to making the work of the society known, encouraging mechanical progress, and extending the professional reputation of its members."

A committee was authorized to be appointed by the President to revise the rules of the society.

The President called for discussion upon papers read at the last preceding meeting, but there was no response.

Among the papers read were the following:

"Rail Cambering Arrangement of the Lackawanna Coal and Iron Company," by Wm. K. Seaman.

"The Protective Value of Boiler Inspection," by F. B. Allen.

"Supplement to Pumping Engines;" also "Back Pressure on Valves," by Prof. S. W. Robinson.

"The Difficulties of Road Locomotion—Their Causes and Cure," by C. C. Hill.

"Systematic Preservation of Drawings," by Oberlin Smith.

"An Adjustable Cut-off for Steam Engines," by H. S. Hayward.

"Refractory Materials," by Prof. Thomas Egleston.

"Launching Ships Side On," by Norman W. Wheeler.

"A New Indicator," by Prof. J. Burkitt Webb.

"An Account of Certain Tests of the Strength and Stiffness of Large Spruce Beams," by Gaetano Lanza.

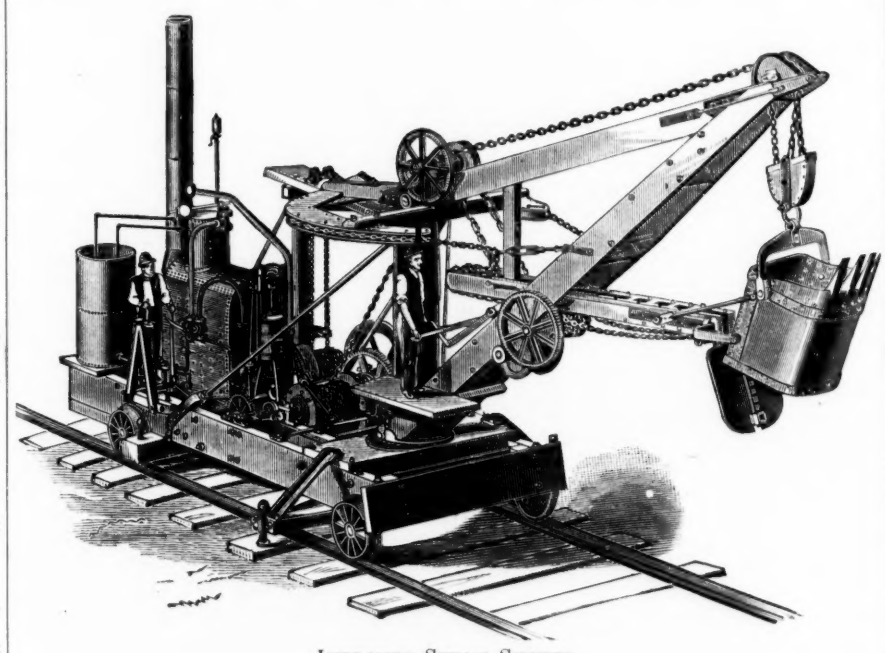
"Technical Schools for Artizans," by Alfred Colin.

President Thurston delivered a lengthy and carefully-prepared address, which we regret the limits of our space will not permit us to reproduce entire. He stated that this was the third address delivered by him, and he mentioned briefly the principal topics treated by him in the two previous addresses. He then spoke of the problems which at present engage the attention of engineers: first, in regard to materials of construction and the handling of metal, we have much to learn.

No maker of steel has been able to give equal density in large and small sizes. The great testing machine at the Watertown Arsenal is constantly at work investigating the strength of large sections and parts of structures. Iron, tough and true, the weapon and the tool, the engine of all civilization, as Theodore Winthrop called it, is displaced now by mild steel. The basic process has cheapened the stock of the steel makers, and will, before many years, make its use so general that puddled or forged iron will be rare. Our systems of inspection and test of materials and of parts of structures are assuming better shape, and soon no supplies will be purchased without being properly tested. The speaker also spoke of the necessity of a universal standard for gauges, and general measurements for the whole country. He also spoke of the improvement in milling grain, stating that the cutting action of millstones is not best adapted to produce good flour, and that the system of gradually crushing the grain by passing it through a succession of pairs of rollers, generally fron 18 to to 24 pairs, is coming inte general use. He also spoke of the progress in the production of electric lights, saying that, despite every difficulty and every objection that has been found, the electric light is steadily and surely coming into a very wide field of application, whereas it was but lately the toy of science. Its beautiful whiteness, its brilliancy and clearness, its power of producing the chemical changes of photography, its freedom from heat, from vapor, and from gaseous, poisonous products of combustion, and even its curiously interesting effect in promoting the growth of plants, must all prove qualities of such importance that its extensive introduction must be soon accomplished.

In steam engine practice, the President said we are not advancing rapidly. The introduction of the drop cut-off in 1841 by Sickles, of the now standard type of automatic valve gear in 1849 by Corliss, of the high speed engine 12 years ago by Allen and Porter, of the combined advantages of jacketing, super-heating and re-heating, and the definite acceptance of the compound engine in later years, still constitute the complete history of modern steam engineering; but we are nevertheless continually gaining a knowledge of handling higher steam, of attaining higher piston speed, of securing greater immunity from cylinder condensation and leakage, and of providing against other causes of waste. We are just beginning to perceive what principles must govern us in the endeavor to secure maximum commercial efficiency, and how economy in that direction is affected by the behavior of steam in the cylinder, and by the mutual relations of all the various expenditures that accompany the use of steam power. The speaker also referred to the great power and speed of torpedo boats, and the possibility that before many years the progress made by engineers will make war so destructive that no nation will dare enter into a naval contest.

The President then dwelt at considerable length on the question of the relations of employers and the working classes. He said that it is from the engineers, if from any body of men, that the world should expect a complete and satisfactory solution of the labor problem. The right of every man to buy and sell labor whenever he may choose, and at the best bargain that he can, is an inalienable right. The right of any man to enter into any branch of industry is also an inalienable right. The privilege of accumulating property is accorded to every citizen, and anything which is in contravention of such privilege should be severely dealt with. No legislation can serve the nation which seeks to help either the capitalist or the laborer alone. The highest prosperity can only come when business can proceed without interruptions, lockouts, or unintelligible legislation. Steps should be taken to secure by systematic legislation a diversification of skilled industry, and a system of technical instruction.



IMPROVED STEAM SHOVEL.

Improved Steam Shovel.

The accompanying engraving represents the recently improved steam shovel, built by the Pound Manufacturing Company, of Lockport, N. Y. These machines are made in sizes capable of excavating from 50 to 200 yards per hour; the one here shown being guaranteed to excavate 1,000 cubic yards of ordinary material per day of ten hours, depositing it on carts or cars ready for removal.

Three men are required to operate it. The consumption of coal is 1,000 pounds per day. The machine will work in any material, from the softest to the hardest; of course in hard pan, the amount excavated being proportionally less.

It will be seen from the engraving that the machinery for hoisting, swinging, etc., is compactly mounted on a strong car, which, in operation, rests on a portable track made in sections. The machine is moved ahead on this track, as the work progresses, by means of the power of the engine. In moving ahead, as a section of the track is uncovered, it is taken up and moved to the front, this operation also being performed by engine power.

For general railroad work the machine is furnished with trucks adapted to standard railway gauge, so that it can be attached to a freight or construction train and transported wherever required, ready for work without special tracks.

In re-designing this machine new patterns have been made, and cast steel substituted for cast iron wherever the wear or strains made it advisable; wrought iron has also been substituted for cast iron for levers, arms, etc. With a view to furnishing parts for repairs, the work is fitted to standard gauges.

Holley Memorial Meeting.

The joint meeting of the three engineering Societies to do united honor to the memory of Alexander Lyman Holley, took place on Wednesday evening, November 1st, 1882, at the Turf Club Theatre, New York. The hall was well filled with ladies and gentlemen, and the memorial address was delivered by Rossiter W. Raymond. The address was a very effective one and was listened to with much pleasure by all present. We understand the address will shortly be published in book form. It is stated by the committee in charge, that about $7,500 has thus far been subscribed for the Holley bronze statue, which it is proposed to erect in Central Park, New York, about $10,000 in all being required.

The Protective Value of Boiler Inspection.

BY F. B. ALLEN, BROOKLYN, N. Y.

A PAPER READ BEFORE THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

From a paper read by Mr. E. B. Martin, before the Institution of Mechanical Engineers at Manchester, England, in 1866, we learn that a very disastrous boiler explosion occurred in London in the year, 1815. That explosion and others that occurred subsequently were made the subject of an inquiry by a Parliamentary Committee in 1817, who recommended among other things: "That boilers should be made of wrought iron instead of cast iron or copper, which had been the materials mainly used previously; that they should be inspected and tested; and that there should be two safety valves, each loaded to one-third of the test pressure under penalties for any excess."

Until 1830, boilers were rarely worked above ten pounds per square inch; indeed seven pounds was the ordinary pressure. After that period the principle of working high pressure steam expansively came into use; the pressures were increased to thirty and forty pounds per square inch, without increasing the strength of the weak forms of boilers then used, and in consequence many violent boiler explosions occurred, directing public attention to the subject, and the necessity for a better system of protection from the occurrence of these sad disasters. Sir William Fairbairn, who had for some years previously interested himself in this matter of boiler explosions, rendering invaluable service to the authorities where inquests were held, (indeed Sir William seems to have been the pioneer of the much abused mechanical expert of our day), organized in the city of Manchester an association of manufacturers and mill owners for the protection of the lives and property of those who were exposed to the dangers of boiler explosions. The association established a system of periodical examinations and inspections, and employed skillful inspectors to have supervision over all boilers operated by its members. The plan worked admirably, not only in the prevention of boiler explosions, but the advice and recommendations made by its inspectors effected an increased economy in the generation of steam, with greater durability of the boilers.

This association has since attained a world wide celebrity, and the contributions of its present Chief Engineer, Mr. Lavington E. Fletcher, in the department of boiler engineering, have been important and valuable.

In a communication by the writer to the AMERICAN MACHINIST, November, 1878, comparing the protection value of the Government test of steamboat boilers under the direction of the board of United States Supervising Inspectors, with that of a more thorough and systematic examination by a boiler inspection and insurance company, compiled from official records in both cases, and extending over a period of six years, it was shown that the cost in losses by explosion for each boiler inspected by the Government was $13.76, while that of the insurance inspection cost per boiler in losses paid $1.18. It will be apparent that the loss reported by the boiler insurance company was only that for which they were liable, and did not represent the entire loss in cases where the amount insured was less than the real value of the property. Assuming that the insurance policy covered but 25 per cent. of the total loss, and this assumption is undoubtedly greatly in excess of the actual amount, we have the cost in losses per boiler inspected by the insurance company at $4.72 or, expressed in protective efficiency the U. S. inspection was to that of the insurance inspection as .343 to 1. In comparing the advantages and disadvantages of the two systems, it will be conceded that the insurance inspection was chiefly that of stationary boilers, whose surroundings are ordinarily superior to those of a marine boiler, while in construction and attendance they are inferior to it.

Mr. Henry Hillier, Chief Engineer of the National Boiler Insurance Co., of England, testified before the "Parliamentary Select Committee on Steam Boiler Explosions," London, 1870:

"The explosions reported to me during the five years ending 31st Dec., 1869, were 288: of these I have obtained reliable particulars of 223, due to the following causes:

First - 80, or 36 per cent., due to defects of construction, either of material or workmanship.

Second—87, or 39 per cent., due to defects arising during ordinary use of the boilers, such as corrosion, fractures and grooving.

Third—56, or 25 per cent, due to actual neglect of attendants, as deficiency of water; and in most cases over-pressure."

Particulars of the remaining 65 explosions not obtained.

Seventy-five per cent. of the defects enumerated above, comprising the first and second predisposing causes of explosion, are those which it is the special province of boiler inspection to discover, either at the first or subsequent examinations; while the system of quarterly visits of inspection made to the boilers while under steam in ordinary use, to examine safety valves, steam gauges and other safety appliances with its attendant supervision over those in charge of the boilers at the time of the inspector's visit, reduces to a minimum the danger to be apprehended from the third, or remaining cause.

I quote from the annual report of the inspection department of the Hartford Steam Boiler Inspection and Insurance Co, as follows:

SUMMARY OF THE INSPECTORS' REPORT FOR THE YEAR 1881.

During the year 1881 there were made 22,412 visits of inspection, being an increase of 1,473 over the number made in 1880; the number of boilers inspected was 47,245, an increase of 2,079 over the number inspected the previous year, while the number of complete internal inspections foots up 17,590, an increase of 1,580 over the number made in 1880. The hydrostatic test was applied in 4,286 cases, the majority of which were new boilers. This is an increase of 796 over the business of the preceding year.

The total number of defects found which were considered serious enough to be reported was 21,110, of which number 5,801 were of a dangerous nature. This does not include many defects of a less serious character.

The following table shows the defects in detail:

Nature of Defects.	Whole No.	Dang.
Furnaces out of shape	1,164	301
Fractures	2,417	1,414
Burned plates	1,180	426
Blistered plates	3,260	468
Cases of deposit of sediment	2,752	532
Cases of incrustation and scale	4,082	494
Cases of external corrosion	1,346	450
Cases of internal corrosion	899	266
Cases of internal grooving	225	128
Water-gauges defective	401	157
Blow-out defective	255	132
Safety-valves overloaded	296	169
Pressure gauges defective	1,647	375
Boilers without gauges	552	51
Cases of deficiency of water	128	101
Braces and stays broken	478	313
Seams leaking	8	3
Defective heads	13	13
Loose tubes	4	
Mud-drums defective	3	3
Dangerous defects unclassified		5
Total defects	21,110	5,801
Boilers condemned	363	
Heads condemned	13	
Mud-drums condemned	3	

We would call attention to the above record of defects discovered, and then most respectfully ask: Is not the periodical inspection of steam boilers of some slight value? There can be but one answer to the above question, and that must be in the affirmative. It is impossible that a system of inspection which brings to light a total of nearly *six thousand* dangerous defects in one year, can fail of accomplishing an incalculable service to the steam users of this country. (*The Locomotive*, N.S., Vol. 3, No. 2.)

Many of the improvements in the construction and material of shell boilers in this country, during the past fifteen years, are due to boiler inspection and its demands for better work, in accordance with the requirements of its standard. A brief review of the principal or more important of these improvements may not be inappropriate in this paper.

Most of us remember the stationary steam boiler of twenty years ago, where the aim of the boilermaker was to place as many small tubes in the boiler as it was possible to do, the value of circulation not being understood or appreciated. Contrast this with the tubular boiler of to-day, with its tubes set in vertical rows, no tube approaching nearer than three inches to the shell, with a clear opening down the middle of from two to six inches, according to circumstances, for a solid body of water, giving better circulation, affording better facilities for cleaning the boiler, as well as for making repairs to the fire sheets when required.

About those mysterious tools known as drift pins, although no boilermaker ever countenanced their use, all shops were provided with them. As an indication of progress, we may congratulate ourselves that evidences of their use are not nearly so common as they were a few years ago.

The advent of machine riveting required a more careful system of laying out and punching rivet holes, to insure satisfactory work in the completed boiler, the drawing of a rivet-head in any required direction, to cover an irregular-shaped hole, being much easier of accomplishment by hand riveting than with the machine. In the matter of calking riveted joints there has been a marked improvement over the carelessness that formerly prevailed with the old method, with the certainty of its breaking the skin of the iron in the under plate. It is wonderful how tenaciously many of our boilermakers yet cling to that old relic of barbarism, the plane-faced calking tool.

The common practice in boiler construction, until recently, was to cut out the shell of the boiler the full size of the dome opening. Many serious explosions have been traced to weaknesses of that kind. In some other cases the appearance of leaks around the base of the dome, that continued to leak after repeated calking, led to an investigation of the cause, and a relief by bracing which prevented the distortion of the weak part around the dome flange. Occasionally new boilers are found defective in this important particular.

The problem of properly supporting long boilers, that so far as practicable there may be an even distribution of the load, is one in which there has been some diversity of opinion among engineers and boiler constructors, as to the best location of the supports to accomplish the object. The need of midway supports on a boiler thirty feet long ought to be apparent to every one, yet inspectors often find boilers of this description with their whole weight resting on their extreme ends (front and rear), the effect of which is to throw an undue strain on the middle girth seams, which, if not discovered in time, and remedied, will cause a seam rip and the projection of the halves of the boiler in opposite directions, with a terrible destruction. The violent explosion at the Allentown Rolling Mill, in January, 1881, by which 13 persons lost their lives, was caused by a defect of this kind. It was estimated in that case that the weight of the boiler structure and its contained water was about 12,000 pounds.

In boiler fittings, the regulations of the United States Steamboat Inspection Service, as well as the inspection and insurance companies at home and abroad, require a proper safety-valve for each boiler. In stationary boilers it should be attached by a nozzle, or some such suitable connection, directly to the shell of the boiler, without intervening stop valves.

The practice of having but one safety-valve for a battery of from two to five boilers is a murderous one, that has been the cause of some of the most disastrous explosions known in this country. This matter is deserving the attention of the authorities, and laws should be enacted in the different States, making the further use of boilers connected in this manner unlawful, and punishable by suitable penalties. In closing this retrospect, special credit is due Mr. J. M. Allen, President of the Hartford Steam Boiler Inspection and Insurance Company, for important investigations and the dissemination of much useful information, notably upon the subjects of the "Holding Power of Boiler Tubes," "Strongest Forms of Riveted Joints," and "Plan for Supporting Long Boilers in Iron Works."

The plan of condemning steam boilers after a prescribed term of years has been advocated, but apparently finds little favor with either engineers, boiler-makers or boiler users. All agree there is a time when a boiler reaches the limits of its usefulness, and should be relegated to the scrap heap, viz., when its condition indicates that it requires that treatment.

The practice of casting away passenger-car axles after a certain mileage, no matter what their apparent condition may be, is now generally adopted by our leading railway managers. This has been cited as one worthy of imitation in limiting the life of a boiler. Desirous of learning the practice of the Pennsylvania Railroad, and whether they had abandoned the one commonly used by engineers of determining the question of condition by an inspection, substituting in its stead the uncertain limitation of age irrespective of condition, I wrote for information to a gentleman who holds a responsible position in its machinery department. He replied as follows: "* * * Now, in regard to the life of a boiler, we do not pretend to place any limit upon their age; all depends upon their general condition, knowledge of which is obtained from weekly inspections or examinations of stay-bolts and fire-box sheets, and internal examinations at intervals. So you see we are mortal like yourselves, and depend upon good material, mechanical skill in construction, and watchful care after they have been put in service for prolonging the existence of boilers."

The protective value of boiler inspection is further demonstrated by the following statement of the Manchester Steam Users Association. "During the past fourteen years the Association has issued upward of 30,000 boiler guarantees, and not a single person had been killed or injured by any guaranteed boiler." (*Engineering*, Vol. 27, p. 258.)

It is understood that the guarantees of this Association are issued only on selected boilers, located within a comparatively small territory, thereby enabling its inspectors to have constant supervision over them. These conditions do not exist in this country, except in our large cities. The metropolitan district of the Hartford Steam Boiler Insurance Co., comprises the cities of New York, Brooklyn and Jersey City; in this district from 1866 to 1882, covering a period of sixteen years, but one explosion has occurred from which death or injury resulted.

During the year 1881, the company issued policies on some 15,000 boilers throughout the country, but two of which exploded. When the fact is taken into consideration that many of its policies are on boilers in sparsely settled parts of the country, run without skilled attendance, in many cases using bad water and subject to many other unfavorable conditions, this showing is indeed remarkable testimony for the protective value of boiler inspection.

The proud record of the Manchester company, the pioneer inspection company of the world, is undoubtedly due, among other causes, to the hearty co-operation of its members in the work of periodical inspection, and a prompt acquiescence in its recommendations. The importance of the subject of boiler inspection in its relation to the protection of human life appeals to every steam user in the land to obtain the most thorough system of inspection offered, and to make suitable arrangements for periodical examinations.

Boilers should be permitted to remain long enough out of service to properly cool, and permit a thorough examination of their setting and fitting. It is now no uncommon occurrence for an inspector to have his shoes destroyed by hot cinders and ashes, or his flesh burned in an endeavor to make an examination of boilers and settings he has been notified are ready for inspection. Such an inspection can be one only in name, and obviously that kind of co-operation on the part of the steam user in preparing for inspection, is not the kind advocated in this paper, nor will it afford the full measure of protection here contemplated.

The greatest need of the boiler inspection service in this country to-day, is hearty and intelligent co-operation on the part of the steam user, by which its efficiency may be further increased.

The Lancaster Steam Pump.

We present with this engravings of a new steam pump, designed for boiler feed or other purposes, and manufactured at the Lancaster Steam Pump and Machine Works, Lancaster, Pa. This pump is arranged to be set in either a vertical or horizontal position, as may be desired. It is simple and compact in design, and arranged with a view to permit easy access to all parts. Fig. 1 shows the pump arranged to stand vertically, with the working parts uncovered, and Fig. 2 represents the same pump enveloped in a dust-tight jacket. This last-named feature is an important one, where the pump is used in exposed positions, as on portable engines, &c. In the manufacture, special attention is given to providing for duplicating the parts at any time.

In the November issue of the *Franklin Institute Journal* appears a paper on economical steam power, by W. Barnet Le Van, in which he says:

"A large number of persons—and they are those who should know better, too—take it for granted that a boiler or engine which is good for one situation is good for all. A greater error than such an assumption can scarcely be imagined.

"It is true that there are certain classes of engines and boilers which may be relied upon to give moderately good results in almost any situation, and the best results should *always* be desired in arrangement of a mill, yet there are a considerable number of details which must be taken into consideration in making a choice of boilers and engines.

A Good Voice Put to a Bad Use.

(FROM "STEAM.")

A group of workmen, who were employed in a mill, were letting down a heavy pulley. An accident had happened to the shaft. It had to be welded and all the line readjusted. The work was done during that silence which so painfully exists during the suspension of ordinary machine labor, when engine, belting, pulleys, machines, men, teams are all silent.

Such circumstances are always irritating, and no wonder that at a critical time in letting down the pulley, and at the occurrence of a little hitch, there should come a volley of oaths and curses at the interruption, given with such emphasis and earnestness that the very walls rung. The door of the office adjoining the mill-room presently opened, and a mild-mannered gentleman walked slowly towards the group, and amid a double silence said, with a quiet and yet rather emphatic tone, "Whose voice was that I heard?"

The whole group hesitated under the impression of an impending censure, if not of a discharge to one of their number. After a second's pause, a reply came, in subdued tones, from a gray-haired workman, "It was mine." Then spoke the mild-mannered gentleman, "Well, you have a most excellent voice, but I am compelled to say that you sometimes put it to a very bad use"—and that was the reproof. The work of repair went rapidly on and was done; but, as the men have many times since smoked their noonday pipes, the story has been told of the gentle reproof and its long lesson—of the excellent voice put to a bad use.

New Fluted Reamer.

We present with this engravings representing the fluted sizing reamer made by the Cleveland Twist Drill Company, Cleveland, Ohio. Of these, Fig. 1 represents a side view, and Fig. 2 an end view on an enlarged scale.

In the construction of this reamer the intention is to provide one that, while it shall have an even number of teeth, so situated as to be calipered for the size, it shall at the same time be free from a tendency to chatter; also one that will, when desirable, increase the diameter of a hole $\frac{1}{32}$", and that will not require to be forced or driven through the hole in reaming it.

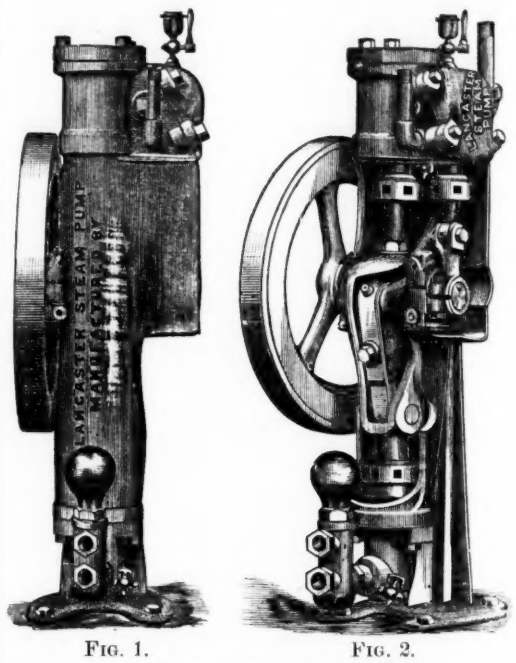


FIG. 1. FIG. 2.

THE LANCASTER STEAM PUMP.

As will be seen by an inspection of Fig 2, the flutes or teeth are, beginning at *A*, pitched each a little less than the one immediately preceding it for one-half the circumference, or to *a*, from which the pitch is similarly decreased to the completion of the circumference. Hence, in using the reamer, the revolution cannot proceed by jerky steps from tooth to tooth, and the tendency to chatter is thereby prevented.

The very considerable amount of taper, as shown in Fig. 1, permits the reamer to enter a hole considerably smaller than the body. This taper part is threaded, the threaded portion acting as a tap, removing part of the material, thus leaving less cutting to be done by the reamer proper, and what is of more importance, the thread advances the reamer a definite distance (equal to the pitch of the thread) at each revolution, thus providing a positive feed which does away with any necessity for otherwise forcing the reamer through the work. The threaded part of the reamer at its largest diameter is slightly less than the full diameter, so as to allow of perfectly smoothing the hole.

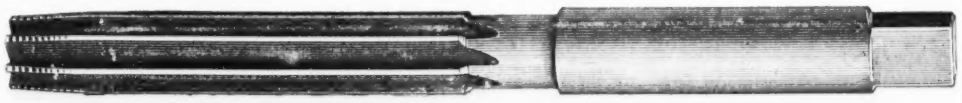


FIG. 1.—NEW FLUTED REAMER.

Of 11,000 grain mills in Holland, it is said that not less than 10,000 of them are operated by wind power.

If a lingering doubt still exists in the minds of the most skeptical, as to the ability or intention of the American mechanic to fill a "want," even before it becomes "long felt," the number who have brought out cheap key-seat cutting machines during the past year or two, ought to remove that doubt definitely and forever.

Bearings and Lubricants.

BY PROF. S. W. ROBINSON.
SCHOOL OF MECHANICAL ENGINEERING, OHIO STATE UNIVERSITY.

In machinery, the proper condition of a journal, when running in its bearing is perhaps quickest told thus: "It is a body floating in a little shallow sea of oil." Like vessels, or other bodies out to sea, it founders when from any cause bottom is struck. Foundering must occur when the sea dries up, but "hard aground" is possible even in the presence of lubricants, if the ship is loaded so heavily as to sink, or even to strike the "hell-gates" of uneven bottom. Also the sea itself is important, because evidently hard sailing would be experienced in a sea of mud, or of tar.

One peculiarity of this kind of sailing is that whenever the ship stops, it soon sinks to the bottom, so that in starting again it must first be towed clear. This explains the increased friction of starting.

From the sailing standpoint, which I believe will be admitted to be a good one, it appears that the lubricant itself should be of the proper sort; one that is entirely free from foreign substances, such as dirt or gum, or anything that interferes with the entire freedom of movement of the journal. Bits of metal, such as filings or fine chips, will make bad enough dirt. The oil space in a lubricating film is exceedingly thin, and there is not room for even fine filings to lie about without the dragging of the journal upon them, giving rise to direct metal contacts for abrasion. Gum causes resistance to motion, so that when a shaft is forced to rotate in a gummy bearing, the work expended on the gum is converted into heat there and then. When this heating condition is established, the more heat the more gum, and the more gum the more heat; until possibly the bearing and all is volatilized.

What is said about gum applies, to some extent, to heavy lubricants; that is, any fluid friction or resistance, such as that offered by beeswax, tallow, lard, or even thick oil, to bodies floating or moving in them, causes the heating of the fluid. The stiffer the fluid, or the more rapid the motion, the greater the amount of work expended, and the greater the amount of heat developed in a given time. Hence, where the motion is slow the stiffer lubricants can be more safely employed than where it is fast. For high speeds, lighter oils are needed. In the case of spindles of factories and for sewing machines, where the power consumed is itself of great consequence, the lighter lubricating oils are doubly essential. This is the case with domestic sewing machines when the power is furnished by a lady's foot.

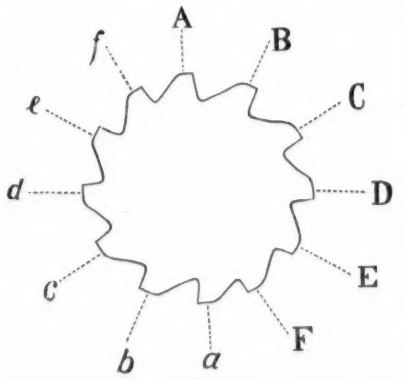


FIG. 2.

The thicker oils flow more slowly from beneath the journal when in motion, than do the light oils; a fact which sometimes makes it necessary to use stiff lubricants, such as tallow, grease or even beeswax, where very heavy machinery runs slowly. In any case the greater pressure, or the greater length of time in a revolution of a journal, either separately or together, should not be such as to so completely force the lubricant from under the journal as to allow the latter to sink into contact with the surface of the bearing. For a given journal and pressure, the greater the fluidity of the lubricant, the greater must be the number of revolutions per minute to prevent the displacement of the oil from beneath; in other words, the greater must be the revolutions per minute to drag the oil under as fast as it flows out..

To better understand this important matter respecting the consistency of the oil, let us consider the physical laws governing a film of oil under pressure between two blocks with flat surfaces. First: capillarity is usually regarded as in some way exercising a controlling influence. But what conditions have we here which are favorable for the development of capillary phenomena? None, except where the surface of the lubricant is free, and also at its junction with the solids. Capillarity can be explained on the theory of a surface tension, or of superficial tension, as it is sometimes called. Thus the tension of the surface of a drop of water, still holding to its support, is that which suspends the water in the manner of a bag containing and supporting sand. The surfaces of a soap bubble film are under this tension, so that the bubble contracts with considerable force, and will eject the contained air when the blowing pipe is free for air to escape.

Now around the edges of the blocks, at the joint, this superficial tension will act at the free surfaces of the exuding oil, and only there. When we consider the extent of this surface and compare it with that of a soap bubble, we find that the whole tractile force due to it is comparatively insignificant for drawing the blocks together. But as to the effect, though slight, upon the space between the blocks, it is to diminish it; for, suppose a drop of oil be placed between two flat pieces of glass, this drop will crawl outward all around the edges, increasing the area of wetted contact until perhaps the whole midspace is filled. As this oil thus spreads, it must necessarily become thinner and thinner until the limits of the space are reached. Hence the tendency of a limited portion of oil in such a space is to grow thinner instead of thicker.

If now we attempt to separate the plates, a considerable effort is required, not, however, to overcome capillarity, except in a slight degree, as above pointed out, but to overcome atmospheric pressure, which, in the attempt at sudden separation, must be overcome nearly to its full value of 15 lbs. per square inch. But by the application of a moderate constant pull for a few minutes the plates will be separated.

That under these circumstances there will be no contracting force of a capillary nature existing to hold the plates together within the area wetted, may be proved by submerging the two blocks and bringing the surfaces into near contact. The space will remain thus narrow, without tendency to decrease or increase. Hence it appears that the force of capillarity is without existence except at the free surface of the oil around the edges of the joint, and that here it is slight, and in the direction of diminishing the thickness of the space.

But in case of the ordinary journal and bearing, the former fills the latter, with the exception of a slight space for oil, all around. Hence here, whatever of capillarity there may be, it is distributed upon all sides around the journal, and nearly counterbalances itself; but its tendency—what there is of it—is to draw the journal out of center, and up to one side of the bearing cavity. But the whole amount of the unbalanced part of this force is exceedingly slight; and, besides,

the surface tension for oil is quite low. From these considerations, it appears that the laws of capillarity are nearly without force, and entirely without controlling influence as regards position of journal in its box. The most important function of capillarity here is to the end of facilitating the entrance of the lubricant into the thin space between the journal and its bearing—a space which should always be left of appreciable magnitude for the oil to occupy.

Now, as capillarity is the only force due to the oil itself, which can act to lift the shaft, it appears that the weight of the latter, with its attachments, will greatly predominate, so that a journal, when at rest in its bearing, is expected to sink down to the bottom of the bearing cavity, until it rests metal upon metal, the oil within being thrown from below around to the top of the journal.

In starting a journal to revolve from its condition of rest just considered, that part of its surface which is in contact with the bottom of the bearing must be at first dragged from the metal-to-metal contact. This makes it "start hard." But as soon as motion begins oil is at once dragged after it, and into the space beneath the shaft's journal formed by this forcible entrance of the oil. When the shaft has made a few revolutions, the oil, which was at first mostly above the shaft in the thicker part of the crescent-shaped cavity, will have become nearly uniformly distributed throughout the circumference, so that the shaft will not touch the bearing, but float in the oil.

Now, if the revolutions are few per minute, the weight may settle the shaft toward the bottom of the bearing, and forcibly cause the oil to flow either way around toward the top of the bearing cavity. Degree of eccentricity of bearing and journal will thus depend upon the weight borne at the journal for forcibly rejecting the oil from below; rate of rotation for dragging the oil back to the underside of the shaft, and degree of mobility of the oil as a liquid.

These considerations may serve in selecting lubricants, as to whether they shall be light or heavy, and with a view to preventing the journal from touching "bottom."

But the condition of the surfaces of the journal and bearing is of importance, equal, if not greater than that of the lubricant. The journal should be absolutely round and smooth. No ridges nor unevenness can be admitted. Wrought iron journals are objectionable, for the reason that iron bars are not homogeneous, and where turned are not round. They are still worse where filed, and yet worse when polished with an emery stick.

The soft parts are most cut away by the file and emery. Absolute roundness can only be secured by lapping, though a hollow die, run wet with soda water, will give perhaps the next best results. The last is free of an objection due to grinding, viz., emery in the surface. When the shaft is out of true by being ridgy, it may be dressed up by scraping, or by local filing.

The bearing should also be very carefully fitted, so that when in use the latter fits the journal with uniformity, but without quite touching it. A minute space should be reserved for the lubricating oil. This space should be absolutely uniform in thickness, except where channels are cut for conducting the oil. The thickness of this space is more than some have imagined, and it is very essential that it be not in the least too thick nor too thin. If too thin there will be a scarcity of oil and an excessive worrying of it, so that it will heat and gum, and the bearing cut and weld solid. On the other hand, too much space for oil will provide too much room for the flowing of the oil, so that as the journal tends to sink in it the crescent form of oil space is easily assumed by the flowing of the oil from the bottom to the sides and top, thus furnishing too little support for the shaft. The journal will then be in danger of striking the bearing below, causing abrasion and heat.

A bearing, like a loose pulley on a shaft, should be put up with slight shake, in order to provide room for oil. Then, when oiled, the shake will disappear. This nice point has been proved practically by the Pratt & Whitney Co. There is philosophy in this matter. For suppose that when dry there be no shake, then when pushed hard on with oil there can of course be no shake. Again, suppose there be much play when dry—say a fiftieth of an inch. In such a space oil will flow along with much less resistance than in a thin space of one or two-thousandths of an inch. Now when this thick space is filled with oil, if the rim of the pulley be forced for shake, a moderate shake will be observed, because the oil cannot flow quickly around from one side to the other as the jerks on the rim would have it. But in the thin space for oil the flow would be slow, so that jerking on the rim will move the oil in the space but a slight distance for each jerk, and the pulley appears to be without looseness on its shaft, because shake is prevented by the presence of the oil.

Now, from all these considerations relative to thickness of oil space around a journal, it appears that it should be so provided for by taking into account the lateral pressure of journal against bearing, the rate of rotation and the mobility of the oil chosen, that the oil will be dragged into the thin compressed space by the rotation of the journal as fast as it flows out, by the pressure and the freedom to flow, and in such relation that the oil space will not become very eccentric or crescent-like. To be more specific, suppose that the oil will flow from bottom to top in a given case in one second without rotation, then it seems plain that the same rate of rotation will be sufficient to carry the oil backward so as to prevent the too great reduction of the thickness of the oil space on the dangerous side.

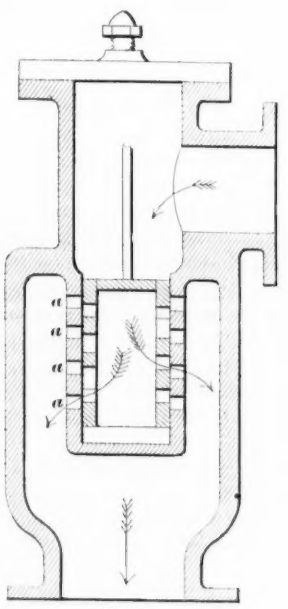


Fig. 1

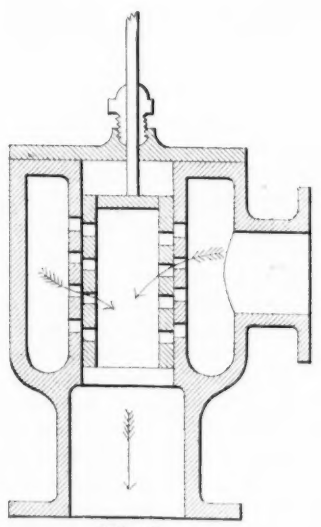


Fig. 2

Now, when the allowance for oil space is duly made, by aid of good judgment or otherwise, the fitting should be as carefully made as though the one surface were to be driven upon the other. That is, the bearing should be cylindrical as well as the journal. The surfaces should be fitted up with a scraper, where the bearings are large, and brought to a uniform fit. Fitting, so that the journal is a true cylinder, while the bearing is bored of double cone shape, or elliptical in cross-section, would never do. The journal would press through the oil at the high place on the small part of the cone, and here would be abrasion. But, by use of the scraper, or file, or both, after the lathe work is done, the bearing and journal may be brought to a near fit, so that the needed film of oil will have a uniformity of thickness along any line lengthwise, and be but slightly crescent-shaped with true circle outlines in cross sections through the bearing. Such a bearing will be expected to run cool, while the bearing which will "soon wear to a fit" will not run cool. In the latter, a cool bearing seems never to be possible, because at first wear is expected in place of scraping, to reduce the points to be worn off, and such wear requires contact of bearing and journal. That contact will injure the journal, making it rough, which, in turn, will cut the bearing unduly. Now, by the time some degree of evenness is supposed to be gained, there will be too much space for the oil. The shaft will then tumble about, knocking against the bearing with such force as to cause metal contacts and rubbing. Both of these actions produce heat as well as continue in aggravation the cause of that heat. In short, in order that machinery journals and bearings shall be correct, they must be *made* right. The "wear to a fit" is utterly out of the question in first-class work; that is to say, fine journals and bearings do not grow like weeds, but must be the result of skill and good judgment, as well as other things.

Perfect adjustment of shaft and bearings is a matter of no less importance than the correct condition of the surfaces. A bearing slightly tilted is as bad as one slightly coned. The part raised by the tilting will bear with excessive pressure and penetrate the film of oil, causing abrasion and heat. Swivel boxes remedy this. A spring of the shaft is as bad as a tilt of the box, so that in shafts, like lines of shafting for transmitting and delivering power, with pulleys all along, it appears to be absolutely necessary that the boxes should be swiveled for the best, or even moderate results. Indeed, in heavier shafts, subject to correspondingly heavy lateral strains, swiveling appears advisable if not necessary. An example of this is found in the main crank bearings and journals of steam engines. Unless they are made so very heavy that they cannot spring appreciably, swiveling seems necessary. An excellent practice in engine shafts is to make them very large and heavy between bearings, to prevent spring due to the thrusts upon the overhanging crank. The bearing itself, however, should be turned down to the minimum diameter, especially at the crank end, in order to reduce the "angle of repose" to the minimum. Then the spring will be chiefly confined to the neck of the journal, in which case it will be much less severe upon the bearing than if the whole shaft is brought down to the same diameter as the neck.

With the crank-pin bearing, the connecting rod is usually so long and thin that it will spring slightly, and allow the bearing to accommodate itself to a slight wabbling motion of the crank-pin.

One of the nice points about babbitted boxes is the fact that the shaft and boxes may be placed in their permanent positions for receiving the babbitt. Then if the journals are in the best condition, the babbitted boxes are found in the proper alignment. A slight scraping will provide the needed space for oil, when the bearing will be found exactly suited for its place and purpose.

One great objection to lapping the journals is found in the fact that the emery of the lap is imbedded in the surface of the journal, where some of it will probably remain forever, to worry and torment the proprietor and his oil bottle. The emery of the surface should always be removed by a careful use of fine emery paper and oil, with frequent wiping in the lathe. The dead surface produced by the lap will then be made clean and bright, and the slight rubbing will have but a trifling effect upon the roundness. Recollection furnishes a bright example of lapped journals and bearings. A feeding attachment for a sawmill was once sent out from a shop for the first time. Being the first, the proprietor was especially anxious that a capital job be made of it. The bearings were solid, carefully drilled and reamed, and the journals ground in with oil and emery. When done and wiped up the journals fitted so perfectly that there was not a particle of shake, dry or wet. This suited the proprietor exactly. It went to the mill and was put to use. In a day or two the thing came back welded solid at nearly every bearing by the great force put upon it by the powerful ratchet wheels, and the second-class judgment of the millman. He knew that it must work because made at a first-class place. But it came back to be knocked to fragments in the attempt to unweld it. However the shop proprictor may have profited by this experience, it is certain that the apprenticcs found in it a lesson which has served for a lifetime.

LETTERS FROM PRACTICAL MEN.

Steam Economy.

Editor American Machinist:

Among the many revelations made by the application of the steam-engine indicator, there are none of greater interest, or more surprising, than the discrepancy between the amount of water accounted for by the diagram and the amount actually pumped into the boiler.

Especially is this true where the ordinary slide valve engine is used, with slow piston speed, and surfaces not protected with non-conducting materials.

Of course all, or nearly all, of this is chargeable to condensation, at once suggesting the propriety of protecting all exposed surfaces, and in every way avoiding this great waste of steam.

There are but few who have the means at hand to make this investigation, or who have any adequate conception of the actual expense of such a waste of steam. The effect of constantly bringing steam in contact with metal surfaces many degrees lower in temperature than itself, is forcibly illustrated by observing the rapidity with which the first fall of snow disappears as it reaches an atmosphere but slightly warmer than itself. In many cases, carrying water in a seive, or holding it in a meal bag, is hardly too strong an illustration of the waste.

I have sometimes thought it would be well if water were more valuable, so that a closer watch might be kept of the amount used in producing a given amount of power.

It seldom occurs to the users of steam that, for every gallon of water going through the exhaust pipe and out of the cylinder cocks, a pound or more of coal is consumed.

The fact is that such persons are not expected to go into scientific investigations of this subject; but, rather that those shall do so who make engines and boilers, and by doing this provide against the greatest enemy to steam economy—condensation.

There is one point in the construction of steam passages with reference to preventing condensation, which I have frequently seen overlooked. This is most frequently seen in the construction of governor valves, and what are commonly known as gridiron valves.

I once constructed a governor valve with four ports, something as shown in Fig. 1; the object being to secure the greatest amount of opening with the minimum of motion. I found that in passing the steam in the direction of the arrows, and in so many thin sheets, that I had *a condenser* and governor valve combined. There was hardly an atom of steam passing but what was brought in contact with the outer shell of the valve chamber.

But when the flow of steam was reversed, as shown in Fig. 2, this effect was obviated in a great degree; the steam in this case

being brought in contact either with an opposite current, or with metal having a corresponding temperature.

This may seem to some of your readers as a "fine point," but in the experiment referred to above I did not so consider it.

DYNAMICUS.

Machine Tools and Machine Work—Forging.

Editor American Machinist:

From the letters that are appearing in your journal concerning the most expeditious methods of tooling off iron, and the policy of quick speed and slow feed *vs.* slow speed and quick feed, there seems to be as great a difference of opinion as there is to whether the long slow stroke or the short quick stroke engine is the thing.

As regards machine tool construction, the advent of special pulley lathes is a step in the right direction. By this means the shears are within a few inches of the height of the centers, thereby making the distance from the cutting edge of the tool to the slides very short.

The double tool system—that is, a tool on the back upside down—seems to be coming into use. A lathe constructed in this way would do very well for heavy shafting.

For heavy cutting, the first thing after the foundation (not the least important part) is to have plenty of weight and metal to resist the cut, without the chattering so common on skeleton face plates and hollow-shelled head-stocks. The next thing is to have plenty of power, which can easily be had with large gear-wheels, small pinions, and large diameter and wide-faced cones.

As a rule, double cutters are best for both internal and external work. The next thing to be considered is the tools. All tools, whether for roughing or finishing cuts, ought to be made of the best cast steel. Much depends on the toolsmith, and fully as much on the grindstone, which ought always to be of sharp grit and kept perfectly true. A good turner, slotter, or planer is very particular in the shape and grinding of his tools. The proper way to grind tools is on a rest at the front of the stone.

From 15 to 20 feet a minute is generally accounted fair speed for cutting wrought iron.

A Liverpool engineering firm contend that by drilling a hole through the steel, and having a stream of water pumped under the cut, tools will preserve their cutting edge without softening longer than if water is dropped on from above.

Nothing leaves a better finish on wrought iron than a water-cut with a perfectly ground tool, touched with an oilstone.

Mild or homogeneous steel roughs out very well with a round nosed lip edged tool with water, but somehow it does not work so well with a flat water finishing tool, as wrought iron.

In Great Britain, and in some marine shops in this country, soapy water, or a mixture of soda, soft soap and water is used. It is also sometimes used on universal hollow spindled turret-headed bolt die-lathes, for cutting off, and turning and threading.

To show how completely some men differ in regard to cutting wrought iron, some foremen advocate turning wrought iron shafting, studs, etc., with dry cuts, then rasping into everything with a file.

Turning light work on centers punched with a center punch ground on the grindstone is also a common practice in country shops. Not only a bad plan, in my opinion, but a very slow one. Where there is no centering or cutting off machine, centers can be quickly made by having a bell-mouthed socket in the live spindle and a center reamer in the tail-stock spindle. A tapered piece of steel run partly under the work till it touches the full side, will true the center in an instant, without stopping the lathe to take out and in.

For boring long holes in wrought iron, say in hydraulic jacks 20″ long and 3½″ diameter, I have found nothing better, in many years' practice, than a half-round bit. This is a most excellent tool. All it wants is a true start, and it is bound to go true, for the simple reason that it can't go any other way. It will cut easily and freely, either out of the solid iron or for a last cut, and will make a perfectly true and parallel hole, no matter of what length.

For cast iron, a flat wooded bit, for a finishing cut for sizing, makes a beautiful, smooth, parallel hole, if only allowed to cut $\frac{1}{32}$″. I have made good holes in marine pumps 4″ diameter and 11 feet long with such a bit. It is a cheaply-made reamer, and if properly used will last a long time, and preserve its size.

A new man came to work next lathe to me once, and put up a slot rest, and pushed such a reamer into a rough hole. When I mildly informed him that such reamers were made for sizing, he replied that he "wouldn't give a cupful of cold water for a flat bit with wood." When holes get below a certain diameter, or beyond a certain length, it is poor policy to turn them out with a small, springy internal tool.

Some might ask, what is the use of making powerful machines; why not get the work forged nearer the size? The work that comes from some of the contract forges, particularly steel crank-pins, is often very roughly forged, because it pays the proprietor better. I have frequently turned forty and fifty pounds of steel off a crank-pin. Sometimes the flat die will have gone deeply into where the journal should be, so that it will barely true up. Such work can never be done in reasonable time on light, powerless, weighted carriage, fine-fed lathes.

We had an A No 1 steam-hammer forger here once. He made special swages for crank-pins; forged a number of them on a long piece and then cut them off. They were nearly the finished size, and almost as true as if turned.

In machine tool construction, there seems to be a difference of opinion about friction. Some contend that friction increases with increase of surface, and others that it only increases according to the weight distributed.

Although the New England builders make slide rests and cross slides for planing and slotting machines with flat bearings gibbed under, their lathe shears have invariably four inverted Vs for the carriage and tail stock to slide on. Some builders now make an inverted V as large as a planing machine V, and one flat surface. English builders, and some in this country, use flat shears angled and gibbed under.

Fort Wayne, Ind. VETERAN.

Machine Novelties.

Editor American Machinist:

I notice in your issue of October 28 a call for new ideas in the line of machinists' tools. In response I venture to offer a few suggestions, which may possibly be new to a portion of your readers.

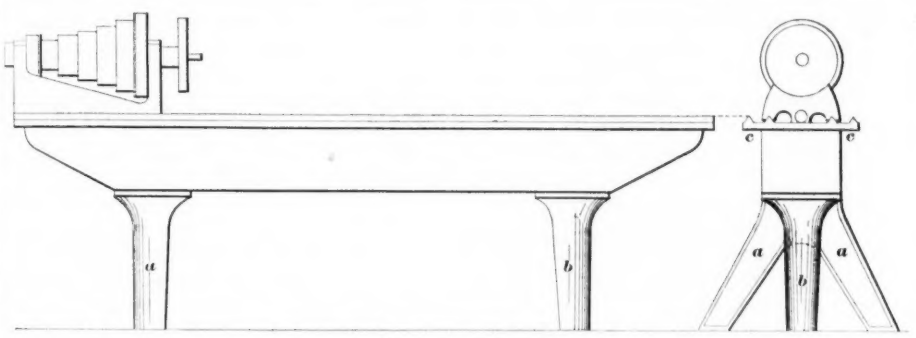
As to lathes and planers, I would suggest that they be constructed with three legs; that is to say, all small and medium sizes, such as are now placed on four legs, and I would have the legs placed a greater or less distance from the end, according to the length of the bed; placing two legs, *a*, at the head, and one, *b* (central transversely) at the foot, as shown in sketch. Such a disposition of legs would give a much more satisfactory equipoise to the machine, and do away with that tendency to sag and twist the bed, which is unavoidable with the present four-legged machine. It requires great care to set a four-legged machine so that each leg shall sustain its due weight, and to keep it in that condition on the average shop floor or foundation.

I would suggest, also, that gears have less depth of tooth, pitch being the same. This would render them more quiet, less liable to break, and more durable under hard work.

Screw lathes should be so fixed that the leading nut could be worked upon any portion of the screw desired, without regard to the position of the tool carriage, in order to equalize the wear of the screw when used extensively for short work. I have seen a device of this kind. I believe it is quite new.

Planers should have a fixed dog upon the sliding bed, in such a position as to permit the bed to travel its extreme limits, and yet operate the shifting lever in season to prevent the bed from running out of gear.

I recently saw in the fair at Boston, a handy device in the belt-shifting gear of a planer. That portion of the shifting dog that strikes the lever is hinged to the body of the dog, so that it may be instantly thrown back and thus prevent the shifting of the belt, in order to let the table come to any desired position for the purpose of adjusting or changing the work without altering the set of the dog. Workmen having a number of like pieces to plane will appreciate this. It was among the exhibits of the Star Tool Company, I think.



A MACHINE NOVELTY.

The tool carriage tracks of lathes, as well as the tracks of planers, should be placed as far apart as the bed casting will permit, leaving no inward angle or ledge between track and edge of bed; as shown at *c*.

F. G. WOODWARD.

Worcester, Mass.

Lathe Feed and Speed.

Editor American Machinist:

"Which do you agree with?"

This was a question asked me by a reader of the AMERICAN MACHINIST in regard to fast and slow speeds and feeds on a lathe.

"I agree with both," I answered.

I am a lathe hand of over fifteen years' experience, on work varying from a quarter-inch bolt to a twenty-inch shaft, and if my humble opinion is of any value, I will give it willingly.

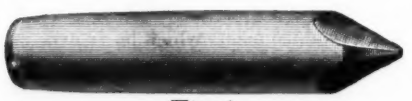


Fig. 1

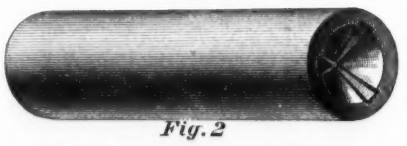


Fig. 2

TRIANGULAR CENTER PUNCH.

Speeds and feeds should be varied according to the material to be turned. In turning heavy work, more time is gained and a better job made by running slow and feeding fast. On small work, fast speed, as fast as the tool will stand, and slow feed, is the best.

If I am put on a lathe, the first thing I do after getting my work ready, is to regulate my speed and feed as my experience teaches me. If the job is a heavy wrought shaft, slow speed and fast feed is what I put on; if a long light shaft that is liable to spring, a fast speed and slow feed; if a cast iron shaft, a slow speed and coarse feed. If the cast shaft should be hard, I reduce the speed and feed so that the tool will stand a reasonable length of time. If the material should be hard steel, I will both feed slow and run slow.

In boring, especially in a deep hole, an advantage is gained by running at a reasonable speed and feeding slow, as there is always more or less spring in all boring arrangements.

I have turned brass, running the lathe very fast, and I have turned brass that a lathe would have to be run almost as slow as if turning steel; but in all cases in turning brass, a fine feed should be used.

The reader may ask, "What do you call a fast feed, or a slow feed?" I must answer that I cannot tell; for what would be fine feed for one piece of work would be a coarse for another. I have used feeds from $\frac{1}{8}$ of an inch to $\frac{1}{60}$, the feed depending on the work that I was on. There is not much use in advising a machinist what feed to use, because there are so many different kinds of work, and every man who runs a lathe should use judgment, and study what kind of feed could be used most successfully on that particular work.

I sometimes take a heavy cut off a piece of work with a fine feed, because the lathe will not pull a heavier feed; and then on the next cut I will feed coarser. I know of lathes that have been run for a long time without the feeds being changed, all because the men running them did not study the question of feeds. FAST AND SLOW.

Pittsburgh, Pa.

Triangular Center Punch, and its Use.

Editor American Machinist:

In your issue of Sept. 9th, you gave a brief notice of the method we have adopted for fixing the centers in lathe mandrels.

The method proves of such value, and of so much wider application, that I send sketches of the tool and its work.

The center punch, shown in Fig. 1, is turned at an angle of about 62 or 63 degrees—that is a little more obtuse than the standard lathe centers—and flattened off on three sides, as shown.

After the work which is to be turned has been drilled and countersunk, this punch is driven in to make three grooves, shown in Fig. 2.

The object is to make a center hole that shall rest without shake on a true center, and what proves to be of far more value, furnish oil grooves for oiling the center without slacking back the foot-stock spindle.

This has proved so good a device that our lathe men use it almost universally. On heavy work it pays both the lathe man and his employer. SUPERINTENDENT.

Straight Line Engine Company.

Graduations on Planer Tool Heads.

Editor American Machinist:

I have worked at iron planing fourteen years, and was therefore amused by Willis Hanaford's letter, in your Oct. 21st number, in regard to the figures on tool heads of planers.

I claim that the fault lies in most draughtsmen, and in the makers of bevel protractors. They reckon from a horizontal line, and the builders of planers from a perpendicular—which latter I claim is the correct way.

I recently made a protractor for my own use, and sent it to our "Model Machine Shop" for graduation, with the order that the 0 should be at the top of the half circle, but it came back to me figured the same as their own make, 90° at the top.

One or the other should change, for I have seen sad mistakes made on bevels by men who were not used to planing. M. C. K.

Providence, R. I.

In Holland, a Royal decree to go into effect in May, 1883, provides that express trains running faster than 37½ miles per hour, must be provided with automatic continuous brakes on the engine, tender, carriages and vans.

AMERICAN MACHINIST

PUBLISHED WEEKLY

BY

American Machinist Publishing Co.

HORACE B. MILLER, Pres't.

JACKSON BAILEY, Vice-Pres't.

LYCURGUS B. MOORE, Treas. and Sec'y.

96 Fulton Street, New York.

JACKSON BAILEY, Editor. HORACE B. MILLER, Business Manager.

LEWIS F. LYNE, F. F. HEMENWAY, } Mechanical Engineers.

The American News Company,

Publishers' Agents, New York.

The International News Company,

11 BOUVERIE STREET, (Fleet Street), LONDON, ENG., will receive subscriptions for the AMERICAN MACHINIST at 16/8 per annum, postage prepaid.

DEALERS SUPPLIED BY

The American News Company, New York.
The American News Company, Denver, Col.
The American News Company, Kansas City, Mo.
The American News Company, Omaha, Neb.
The American News Company, St. Paul, Minn.
The New York News Company, New York.
The National News Company, New York.
The New England News Company, Boston, Mass.
The Central News Company, Philadelphia, Pa.
The Western News Company, Chicago, Ill.
The St. Louis News Company, St. Louis, Mo.
The Cincinnati News Company, Cincinnati, Ohio.
The Detroit News Company, Detroit, Mich.
The Pittsburgh News Company, Pittsburgh, Pa.
The Baltimore News Company, Baltimore, Md.
The Rhode Island News Company, Providence, R. I.
The San Francisco News Co., San Francisco, Cal.
The Brooklyn News Company, Brooklyn, N. Y.
The Williamsburgh News Co., Brooklyn, E.D., N. Y.
The Newark News Company, Newark, N. J.
The Northern News Company, Troy, N. Y.
The Albany News Company, Albany, N. Y.
The Washington News Company, Washington, D. C.
The New Orleans News Company, New Orleans, La.
The Montreal News Company, Montreal, Canada.
The Toronto News Co., Toronto, Ontario, Canada.
The Toronto News Co., Clifton Branch, Clifton, Ontario, Canada.

SUBSCRIPTION.

$3.00 a year, in advance, postage prepaid in the United States and Canada.
$4.00 to Foreign Countries, postage prepaid.

ADVERTISING.

Transient, 35c. per line each insertion.
"Business Specials," 50c. a line.

EDITORIAL ANNOUNCEMENTS.

☞ *Positively we will neither publish anything in our reading columns for pay or in consideration of advertising patronage. Those who wish to recommend their wares to our readers can do so as fully as they choose in our advertising columns, but our editorial opinions are not for sale. We give no premiums to secure either subscribers or advertisers.*

☞ *Every correspondent, in order to insure attention should give his full name and address, not for publication, but as a guarantee of good faith.*

☞ *We are not engaged in procuring patent rights, or in selling machinery; nor have we any pet scheme to advance, or hobby to ride.*

☞ *We invite correspondence from practical machinists, engineers, inventors, draughtsmen, and all those especially interested in the occupations we represent, on subjects pertaining to machinery.*

☞ *Subscribers can have the mailing address of their paper changed as often as they desire. Send both old and new addresses. Those who fail to receive their papers promptly will please notify us at once.*

NEW YORK, NOV. 18, 1882.

CONTENTS.

PAGE

Improved Otto Gas Engine 1
New Boiler Shop Punch 1
Accident Upon a Locomotive 1
New Upright Drill 2
Report of the Tariff Commission 2
New Iron Planer 3
Annual Meeting of the American Society of Mechanical Engineers 3
The Protective Value of Boiler Inspection. By W. B. Allen 4
The Lancaster Steam Pump 5
A Good Voice put to a Bad Use 5
New Fluted Reamer 5
Bearings and Lubricants. By Prof. S. W. Robinson 5
Letters from Practical Men—Steam Economy—Machine Tools and Machine Work; Forging—Machine Novelties—Lathe Feed and Speed—Triangular Center Punch, and its Use—Graduations on Planer Tool Heads 6, 7
Machinery Prospects 8
A Visit from a Scotch Tool Builder 8
Criticising Machine Shop Practices 8
That Evening Drawing School for Mechanics 8
Questions and Answers 9
Manufactures 9
Machinists' and Engineers' Supplies 10
Iron and Metal Review 10

Machinery Prospects.

Indications point to a curtailment of new railroad construction for the coming year, which is likely to have an important bearing upon the machinery industry. The extraordinary construction of the last few months has had much to do with the unprecedented activity in building new machinery and tools. With a falling off in this direction it cannot be expected that orders for machinery will be as pressing as they have been. This condition of business must be favorable to the purchasers of machinery, as they will have their orders filled more promptly, and in some cases at lower prices, but there is no reason to expect any such declination in prices or demand as was experienced seven or eight years ago. The multiplicity of productive industries, requiring both new machinery and repairs of that already in use, must necessarily give an unfailing business to most of the machine shops now in operation. Even though railroads furnish more business to machine shops than any other industry, it does not follow that checking their progress will cause disaster to the manufacturers of machinery. Railroads must depend upon the volume of public business, and if more lines are built than warranted by the increase of general traffic, whatever there is to be obtained must be spread out thinner. When fewer new lines are being constructed, those in operation may be expected to receive all the carrying trade that would otherwise go to new lines. With the same volume of railroad traffic and general business, machine shops are not likely to be ultimate losers whether railroad extension goes on rapidly or sluggishly. Many of the orders for machinery that have been placed six to ten months in advance, were on account of new enterprises, or extensions of old ones, for which no present need existed. The future demands of business have been largely discounted both in railroad extension and in some productive industries, therefore the builders of machinery will not be crowded so lively as they have been, until a season of equalization has passed.

A Visit from a Scotch Tool Builder.

We recently had the pleasure of a call from William Shanks, of the well known firm of Thomas Shanks & Sons, the largest machine tool building establishment in Scotland. Mr. Shanks has been spending some weeks in travel in the United States, extending his trip as far West as Chicago, and visiting most of the prominent machine shops in the part of the country through which he has traveled. He expresses himself as highly pleased with the courtesy extended him in the way of facilities for inspecting the industrial establishments which he visited, but criticises, as might be expected, with considerable freedom, the processes and the character of the work of some of our prominent establishments. Amongst those commended by him are the Brown & Sharpe Manufacturing Company, the Pratt & Whitney Company, the Niles Tool Works, the Southwark Foundry and Machine Company, and Grant & Bogert. Mr. Shanks expresses himself as—in addition to the pleasure of his visit—having found it profitable in the way of knowledge gained.

Criticising Machine Shop Practices.

Probably one of the most common criticisms of intelligent foreign mechanics on machine shop practice in this country, has reference to the manner in which the work on some of the larger parts of machines and machinery is done; that is, to the lack of a definite systematic application of special tools to these parts of machine construction. That there is in some instances good ground for such criticism is undoubtedly true, and doubtless American manufacturers may profit by this criticism oftener than they do. But it is also quite as true that this criticism is not always, as might be expected, tempered by a consideration of all the circumstances that govern the case.

That the value of special machines and tools for special work is understood and appreciated by machine shop proprietors here, may be seen from their extensive use for the production of the smaller and more common parts of machines, and especially in the manufacture of small tools. In this respect the best practice here will not suffer by comparison with practice anywhere.

It is unquestionably true that the use of expensive special machinery in the manufacture of the larger and less common parts of machines and machinery is more general, in Great Britain, for instance, than in this country; but the reason is not, as criticism sometimes attempts to point out, entirely, nor mainly, that the value of such machinery as used there is not appreciated here, but rather that the capacity of our machine shops, as a rule, does not permit of its economical use to the same extent here as there. Before the comparison in this respect can be properly made, it is necessary to consider the fact that an expensive tool, which can be profitably used in a shop employing 2,000 men, would be an expensive luxury in a shop employing 500 men. At present the large American machine shops are more likely to number their workmen by the hundreds than by the thousands. The question is not altogether whether a special machine will enable some part of the work to be done quicker, but whether there is enough of that particular kind of work to warrant the outlay for that machine.

But if the force of circumstances sometimes compels deciding against the use of costly special machinery on heavy work, and where its use under other circumstances would be advisable, perhaps the attention that is given here to the use of small special machinery will be found, in comparing the best general American machine shop practice with the best practice elsewhere, to have not less than equalized the matter. Criticism need not be expected to take account of this.

On the other hand, it is always worth considering whether the use of large special machinery is as extensive in this country as it might profitably be. In a business that has come up, for instance, from a small beginning, as most machine shop enterprises have come up here, there is always the probability of holding too long to old practices, some of which headway has been made in spite of, rather than by means of their aid. There is a certain charm in long continued association that sometimes induces continuing the connection after it ceases to be profitable, and no one more than the mechanic delights in devising ways and means in preference to taking them second-hand. It is in these respects that intelligent outside criticism should be taken advantage of, as sometimes it is possible to profitably study one's self through other's eyes.

While, as previously intimated, it need not be admitted that, taken as a whole, American machine shop practice will suffer by comparison with corresponding practice elsewhere, it is always advisable to study the possibility of reforming that practice in specific directions, whether the hint to do so comes through criticism or otherwise.

That Evening Drawing School for Mechanics.

In the AMERICAN MACHINIST of Oct. 28, 1882, we published an editorial advocating the organization of evening drawing schools for mechanics, for the coming winter. Railroad companies as well as manufacturers were advised to start evening drawing schools for the instruction of their apprentices and workmen, as a paying investment. The advantages and benefits which would be realized by the proprietors from the outlay were described in detail. It has been said by some shop proprietors that apprentices and mechanics would not attend such a school. We are compelled to take exception to this statement for several reasons. First: most of the persons from whom these assertions come never tried the experiment, and those who have taken any steps at all in this direction and found their efforts unsuccessful, can easily trace their failure to the fact that the experiments were half tried; or in other words, what little may have been done was with an apprehension at every step that the whole movement would prove a failure. This is no way to try such an experiment, but the work should be laid out and executed with the same determination that a new style of steam engine or other piece of machinery is designed and built. Second: wherever the experiment has been properly tried it has been a success. The value of these evening schools, both to employers and employes, cannot be over-estimated.

A few years ago such a drawing school as we refer to was organized in this city by that great philanthropist, the venerable Peter Cooper, for the benefit of boys and young men who were by their various pursuits during the day prevented from attending school. From the time the first drawing class was opened in Cooper Union, until the present time, the attendance has been increasing. The number of applicants has been much greater than could be accommodated, so much so that there are now about *five hundred* young men and boys who are waiting for vacancies to occur in the classes in mechanical drawing.

In addition to the classes in mechanical drawing, there are also classes in artistic and architectural drawing, besides arithmetic, algebra, philosophy, chemistry and geometry. This we consider abundant evidence that the attendance would not be a valid objection to the opening of evening drawing schools. We all know the power that exists in the social element, therefore we should not be discouraged if the first evening should only bring a corporal's guard. If the school is worth anything at all, those who do attend will become missionaries, and spread the merits of the school so that in a short time it will be found necessary to take a larger room.

In taking apprentices, it ought to be made one of the conditions upon which boys are received to require them to attend the evening drawing school of the concern, as is done in some establishments in this city. By taking this step, the proprietor not only puts the boys in the way of growing up intelligent mechanics, but, by giving them pleasant and profitable employment (recreation for them) evenings, they are kept out of the way of temptations to do things which would ruin them for all honorable pursuits in the future.

We are constantly in receipt of letters from boys and young men asking advice for books, or desiring us to map out a course for them to follow, in order to attain success in their particular callings. We also receive inquiries in reference to the best course of self-instruction, which proves that there are a great many boys and young men who are anxious to learn, but are unable to find the proper opportunities. If there were another institution in New York City of the same character as the Cooper Institute, it would, in all probability, be filled; and it is a lamentable fact that there is but one institution of that kind here, or elsewhere. This is a direction in which capitalists might demonstrate their philanthropy, by endowing another such an institution as the Cooper Union, for those who are prevented from getting an education by their daily occupations.

The five hundred young men and boys to whom we alluded are waiting for an opportunity to learn, and the question now is, How long will this waiting continue? It will continue until there is a vacancy in the above Institute, or until some other similar institution may be opened. In the meantime, these individuals must plod along and study as best they can, either at home or in their rooms at the boarding house. We shall never forget those long winter evenings in the boarding house, when we had to put on our overcoat and cap to keep ourself from freezing while in the pursuit of knowledge. It requires a generous supply of determination to make the start, and to continue under all sorts of difficulties: but if the individual perseveres, the warm, cozy room

and pleasant associations will be sure to come eventually.

One of the most satisfactory things in life is to look back over the past, and see how many individuals have been benefited by the aid of our assistance and co-operation. We hope that our friends, the proprietors of shops and factories, will not be discouraged before they try the experiment of starting evening drawing schools, that are now working successfully in so many places.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

(397) J. T. H., Cambridgeport, Mass., asks: What metal expands the most by an increase of temperature? *A.*—Of the common metals, zinc.

(398) Pattern, Philadelphia, Pa., asks: How can I determine how to make a heart for a rectilinear motion? *A.*—Consult any work on the drawing of machinery.

(399) H. A. S., Charlotte, Maine, asks: Are there, in your opinion, any boilers made that are absolutely safe from disastrous explosions in the hands of unskilled persons? *A.*—We shall decline to recommend any boiler as absolutely safe under the circumstances named.

(400) Subscriber, Chicago, Ill., asks: Please inform me how to ascertain the size of safety valve to be used on different boilers? *A.*—There is no established custom in this respect For ordinary boilers with natural draft, one inch area of valve for each 1¾ foot grate surface, may be taken as good practice.

(401) J. S., Savannah, Ga., asks: 1. Why does a belt run to the high side of a pulley? *A.*—It is owing to the effort of the belt to keep itself straight in a direction from the face of the pulley. By making an exaggerated sketch you will be able to see it clearly. 2. Why are car wheels cored? *A.*—To get the maximum of strength with the minimum of weight.

(402) G. F. E., New Haven, Conn., asks: 1. Will you please inform me if a pair of 18″ bevel wheels cut from steel can be run at 1,000 revolutions per minute without noise? *A.*—No. 2. Is it practicable for a worm wheel to drive a worm, and if not, why not? *A.*—The angle of the teeth is such that the effort of the wheel is expended in end thrust against the screw.

(403) L. L. E., Trinidad, Col., writes: I notice an engineer who, when he banks his fire, closes the ash pit and fire doors and opens the flue doors and damper. My plan is to close the ash pit doors, leave the flue doors closed, and if any doors are open let it be the fire doors, a little. Which plan in the best? *A.*—Yours. It is wrong to open the flue doors.

(404) E. F. G., Brooklyn, N. Y., writes: I have for some time been looking for an engine of 100 horse power that does not require a fly wheel, but cushions on both ends with steam. Can I get such an engine? *A.*—There is no one who builds stationary engines that will run successfully without a fly-wheel. Cushioning does not do away with the necessity for a fly-wheel.

(405) R. R. V., Wansa, Wis., writes: A party here pumps his water from the river, which is quite a distance. The suction pipe is vertical from the water to a height greater than that of the pump, and then runs to the pump. Is there any gain in this arrangement, over inclining the pipe all the way from the water to the pump? *A.*—So far as your statement goes we can see nothing in favor of the arrangement of pipe mentioned.

(406) G. E. M., Chicago, Ill., asks: If I have a 3″ steam pipe one mile in length, laid quite level, and exposed to a temperature of 60°, and keep steam in this pipe, say 4 weeks with no outlet or leak, will a gauge at the farther end of this pipe show the same pressure as the gauge at the boiler which supplies the steam? *A.*—Two correct gauges, one at each end of the pipe, will show the same pressure. If the pipe is below the boiler this pressure will be a little greater than the pressure on the boiler.

(407) J. B. W., Cincinnati, Ohio, asks: 1. What is meant by the terms under and over as applied to the motion of a steam engine? *A.*—An engine may be said to run under when in the motion of the cross-head away from the cylinder the crank-pin passes through the half of its revolution below the crank shaft, and over when during the same motion of the cross-head the crank pin passes through the half of its revolution above the crank shaft. 2. What is meant by the term with the sun? *A.*—Right hand revolution, the same as the hands of a clock. 3. How are the angles for bevel gearing obtained? *A.*—By making a drawing of the gears.

(408) C. W. B., Portland, Maine, asks: 1. Which will expand the most under the influence of heat, brass or copper? *A.*—Brass. 2. Is the expansion of metals the same, for definite increase of heat, at high as at low temperatures? *A.*—We are not aware that experiments have ever been made that definitely settle this. 3. Will a brass rod ¾″ diameter expand the same as one ½″ diameter, for the same increase of temperature? *A.*—Yes. 4. How much will a ¾″ brass rod expand per foot in length? *A.*—According to Faraday, a brass rod 1 foot in length at a temperature of 32°, will by having its temperature increased to 212° be 1.00191 feet in length.

(409) J. A. B., North Attleboro, Mass., writes: A friend of mine has a No. 3, Knowles pump that lifts water from a well 13 feet deep, and discharges it into a tank 34 feet above the pump. The tank holds 4033.6 gallons. He contends that it requires a quantity of steam equal to 30 horse power to elevate this water, whether it is done at once or is pumped into the tank during 4 or 5 hours. I think he is wrong, both as to the steam expended and as to the time occupied in doing the work? *A.*—As you state your friend's case it is not clear. "A quantity of steam equal to 30 horse power" means nothing, unless the element of time is given. 4033.6 gallons of water will weigh, say, 33.478 pounds, and the height to which it is raised is 13+34=47 feet, so that neglecting friction in pipes, the number of foot pounds required to lift the water is 33478×47=1573507. If this work is done in 1 minute it will require the exertion of 1573507÷33000=48-horse power during that time. If done in 60 minutes the horse power would only be 1-60 as much. Theoretically, the fuel consumed in doing the work would be the same in either instance.

(410) V. W., Milwaukee, Wis., writes: We have lately had trouble with an 18″ piston of a Corliss engine. It is a common piston, with two outside rings 5/8″ thick and 2¼″ wide, and one inside ring ½″ thick and 4½″ wide. The outside rings are cut slanting, and the inside ring straight, across. In spite of the most careful workmanship, the rings changed their position in the cylinder twice within 4 weeks, so that all the cuts in the rings came in line, causing a loud noise. We have put dowel pins in the rings, and since then the rings have remained in their proper positions. We have never had this occur before in our practice, and should like to have your opinion as to what caused the turning of the rings, and also what caused the noise in the cylinder. Is it possible that the sudden ingress of steam may have, in connection with the angular slot through the outside rings, something to do with their turning? *A.*—There is always a possibility of packing-rings shifting their position in the cylinder unless they are doweled, or otherwise restrained. The cause is not always easy to determine. Sometimes the alignment of the engine is such that a slight rotary movement of the piston occurs, which will have a tendency to displace the rings after a time, and sometimes a scored place in the cylinder will operate to change them. The action of the steam suddenly admitted, especially if the engine is working without much compression, might have the effect to turn the rings as you suggest. It would be impossible without an examination to tell in that particular case what brought around the result mentioned, and it very probably would be difficult of determination after the most careful examination. With reference to the noise, you do not state the character of it. With all the cuts in the rings in line, there would be nothing, so far as the packing is concerned, from preventing the steam blowing directly through to the other side of the piston, which would result in considerable noise; or the sudden introduction of steam by the way of the cuts might expose so much surface of the piston to the pressure of the steam as to lift the piston in the cylinder, which would of course make considerable noise.

BUSINESS SPECIALS.

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

"Cures Bad Draft," Parson's Blower on trial.

F. Samuelson, Pattern Maker, 38 Gold St., N. Y.

James W. See, Consulting Engineer, Hamilton, O.

Steel Name Stamps, &c. J. B. Roney, Lynn, Mass

Portable Forges, $10. Holt M'f'g Co., Cleveland, O.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N.J.

"Makes More Steam or No Pay." Parson's Blower, 95 Liberty St., N. Y.

J. M. Badger, Expert and Commission Dealer in Machinery, 5 Dey Street, New York.

Hoerle Bros., Naugatuck, Conn. Small Dies and Special Tools to order.

J. C. Hoadley, Engineer and Expert, 29 High St., cor. Federal, Boston, Mass.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York.

Howard S. Abbot, Solicitor of Patents, 617 7th St., opposite the Patent Office, Washington, D.C.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Foot Power Machinery, for workshop use, sent on trial if desired. W.F. & John Barnes, Rockford, Ill.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

The American Standard of Bolts and Nuts. Price $1.00. Address, E. Lyman, C.E., New Haven, Conn.

Pattern Maker's Assistant. By Joshua Rose. 324 pages, $2.50 by mail, postpaid. Address orders, P. O. box 3,306, New York City.

A lot of 25″ lathes designed to equal the best Philadelphia tools, will soon be ready for delivery. Ohl & Co., E. Newark, N. J

Engine Lathes, Speed Lathes, Foot Lathes, Upright Drills, Light Drilling Machines and other fine tools, Frasse & Co., 62 Chatham St., N. Y.

Wanted—To sell a Richards' Indicator in good condition. Address, F. G., BOX 1, AMERICAN MACHINIST.

For Sale.—Steam Engine, extra heavy, in good order, upright, two cylinders, each 12″x30″, heavy fly wheel 7′x2′, Judson governor, bed stone, &c David W. Pond, Worcester, Mass.

Jas. F. Hotchkiss, 84 John St., N. Y.: Send me your *free* book entitled "How to Keep Boilers Clean," containing useful information for steam users and engineers. [Mention this paper.]

L. V. Conover, Iron Founder, 336 to 340 East 29th Street, New York. Heavy and Fine Castings of Iron, Brass, Composition and Copper made to order at shortest notice.

We will pay 25 cents each for copies of the AMERICAN MACHINIST for January 1, 1881, which are clean and in condition for binding. American Machinist Publishing Co., 96 Fulton street, New York.

Russell & Struthers, Wax Process for making outline engravings. Specimens each week in the AMERICAN MACHINIST. We also do Map Engraving with best facilities. Russell & Struthers, 59 Park Place, New York.

Wanted to arrange with the right parties for the manufacture on royalty or otherwise, of a first-class automatic cut-off engine. Address, Box 10, care AMERICAN MACHINIST, 96 Fulton street, New York.

Our new patent hand-file holds about four copies of the paper in good shape. Very handy for office or library use. Mailed on receipt of price, 75 cents. American Machinist Publishing Co., 96 Fulton street, New York.

The Theoretical and Practical Boiler Maker, 335 pages, and 37 lithograph plates. Published by the author, S. Nicholls, Yorkshire street, Blackpool. Mailed on receipt of P.O.O. value $1.83, to Blackpool, England See Review, AMERICAN MACHINIST, p. 8, July 22, 1882.

Boiler Shop Tools.—Patent Bending Bolts, Boiler Plate Planers, Combined Punch and Shears, Single Punches or Shears of short or very long reach, Horizontal Flange Punches, Double or Single Bar Iron Shears, Radial Drills. Send to Hilles & Jones, Wilmington, Delaware.

Bound Volumes and Patent Binders. We can furnish Volume 3 of the AMERICAN MACHINIST, containing the full 52 issues of 1880, or Volume 4, containing the 53 issues of 1881, neatly bound in cloth, ready to ship by express, for four dollars. Either volume unbound, three dollars. "Patent Binder" for the AMERICAN MACHINIST holds 53 weekly issues in good shape. Sent to any address by mail for one dollar. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton Street, New York.

"Extracts from Chordal's Letters," the most interesting mechanical book published. A great variety of mechanical and business topics treated in a way that will be instructive to old and young mechanics, and interesting to every body. Over 40 humorous illustrations; 320 pages, 12mo. Price, $1.50 per copy, by mail, to any address. AMERICAN MACHINIST PUBLISHING CO., 96 Fulton Street, New York.

The *Sanitary Engineer* of Oct. 19, publishes with illustrations the report of Chief Engineer Durand Claye, of Paris, on the just completed Sewerage System of Berlin. It presents in each issue a great amount of matter of special interest to engineers, contractors, steam fitters and plumbers. If any reader of the AMERICAN MACHINIST who may now be buying the *Sanitary Engineer* of news dealers, will request it, the publisher will send him two weekly issues free if this advertisement is referred to. Address the *Sanitary Engineer*, 140 William street, New York. (P. O. box, 3037.)

MANUFACTURES.

The Valley Iron Works, Appleton, Wis., is a new joint-stock industry.

The Fort Scott, Kansas, Foundry and Machine Works, are building new tools, steam hammer, and a lot of the most improved machinery.

Plans for the establishment of a watch factory at Bloomington, Ill., are maturing. It is proposed to organize a company with a capital stock of $150,000.

Merrill & Houston, iron founders and machinists, Beloit, Wis., are adding a new foundry 70x130, feet, with considerable additions to machine shop, wood shop, etc.

The Langdon Mitre Box Company, of Miller's Falls, Mass., capital stock $20,000, is a new corporation. George E. and Dana C. Moyes are the president and treasurer, respectively.

The builder of the Harris-Corliss engines, William A. Harris, Providence, R. I., has broken ground for a four-story brick building to be used as a foundry and for storage of patterns.

The E. Horton & Son Co., Windsor Locks, Conn., are building an addition to their works, made necessary by the increase of trade. They are employing 38 hands, and have been running on 13-hour time.

The Fuller & Johnson Manufacturing Company of Madison, Wis., have added to their extensive business the manufacture of the Conradson Wind-Mill, invented by a graduate of the Wisconsin State University at Madison.

Professors Owen and King of Wisconsin State University at Madison, have associated themselves together and will proceed at once to the erection of buildings and the equipment of plant for the manufacture of first class machinists' tools.

F. E. Reed, Worcester, Mass., is adding 14″ and 16″ lathes to his patterns for manufacture. The 14″ lathe is now ready, and the 16″ will be ready in about a month. He employs about 50 men and orders continue to be very brisk.

The Rubber Manufacturers of the United States, in session in New York, adopted a resolution to close factories on and after December 23, 1882, and to keep them closed until the price of rubber shall fall to a point which warrants them in resuming.

Eighteen of the twenty machine tool builders in Worcester, Mass, have their products upon the market and are very well supplied with orders. The other two will not offer machine tools for sale until orders for their other productions are less pressing.

James Mahony, 73 Astor House, New York, has issued a new descriptive circular of his Universal Patent Furnace, which he will mail to any one upon application. It also gives extracts from a test made by Geo. H. Barrus, an expert engineer, which show a marked economy over the ordinary boiler setting.

Franklin Farrell, President of Farrell Foundry and Machine Co., has a sugar estate in the Negro Republic of Santo Domingo. He is about to have all his boiler furnaces on that estate torn down and reconstructed on the Jarvis system, to burn the crushed sugar cane as it comes from the rollers.

C. B. Cottrell & Co., No. 8 Spruce street, New York, manufacturers of printing presses, have recently made extensive additions to their works at Westerly, R. I., notwithstanding which they are obliged to run 24 hours a day to keep up with their orders. They are working from 300 to 400 men, with business steadily increasing.

Ward & Curley, brass founders and manufacturers of brass work, Boston, Mass., are putting in a new lot of lathes and other tools. They are also making some additions to their foundry. These changes will increase their capacity to quite an extent, although their present business in that line is large, giving employment to between forty and fifty hands.

The Vulcan Iron Works, at Kansas City, Mo., have just taken possession of their new works, and will turn their attention to the manufacture of tools and general machinery. Next season the works will again be enlarged. About $15,000 worth of machinery of the latest improved design has been added to the works, which are being operated on full time.

The Nashville Cooperage Co. are putting in a new steam outfit in their works, at Nashville, consisting of a pair of 16″ engines and three 60″×14′ boilers, with fixtures complete, all built by the Atlas Engine Works, of Indianapolis. The slide valve engine exhibited by the Atlas Engine Works, at the Little Rock (Ark.) Fair was awarded the first premium.

Marshall Cutler, of Boston, is erecting chemical works in East Somerville, Mass. Gooch & Pray, of Malden, have the contract for erecting the buildings, and the Whittier Machine Co., of Boston, will supply the boilers, which will be set with the Jarvis furnace to burn cheap fuel. The engine will be furnished by Wm. A. Harris, of Providence, R. I.

Some locomotives are approaching completion at the Cooke Works, at Paterson, N. J., for the Central Pacific Railroad, which are believed to be the largest in the world. They have eight driving wheels and four wheels under the forward truck, and weight 63 tons, or 10 tons more than the "consolidation" engines. The cylinders are 20 by 30 inches. These locomotives are to be known as the "mastodon."

W. C. Young & Co., Worcester, Mass., are getting out a 10″ lathe with the spindle fitted to take drills up to 9-16″ without any socket or chuck. The hole in the spindle corresponds to the Morse Twist Drill Co.'s taper. A demand has arisen for such a lathe, and this firm is the first to meet it. They are also constructing a special machine for cutting edge irons for boots and shoes. The latter is to be used in their own shops.

Jarvis, Barnes & Co., Lansing, Mich., who started in business about two years ago in the Lansing Iron Works, are working eighty men, with large orders on hand. They build stationary and portable engines, complete sawing rigs, &c. They are about putting on the market a new automatic engine. Mr. Jarvis informs us that since the first of January last, they have made seventy engines of various sizes, and one hundred saw mills.

The establishment of the United States Rolling Stock Company's works, on the banks of the Calumet, includes one hundred acres lying about 2,000 feet south of what is known as Stony Island, the place where the shops of the new "Nickel-Plate" road are being built. The site is about two miles directly west of South Chicago, and about two miles northeast of Pullman. Half a million dollars will be expended before June 1, 1883, and about 1500 men will be employed when the shops are completed.

The Pratt & Whitney Co. have finished since Jan. 1, 1882, nine hundred and eighty machines, consisting of the following: Engine lathes, 160; Hand lathes, 17; Turret-head and Chucking lathes, 28; Spinning lathes, 4; Cutting-off lathes, 20; Drilling machines, 198; Planers, 46; Crank-shapers, 10; Pillar-shapers, 18; Shaping machines, 6; Automatic and hand feed revolving head-screw machines, 200; Screw shaving machines, 6; Power and hand milling machines, 125; Diesinking machines, 4; Boring mills, 3; Profiling machines, 10; Drop hammers, 6; Bolt heading machines, 5; Hand bolt cutters, 30; Power boltcutters, 26; Tapping machines, 25; Screw slotting machines, 13; Sundries, 20.

Machinists' and Engineers' Supplies.

NEW YORK, Nov. 2, 1882.

The general condition of the supply market continues unchanged. The probability is that business will remain quiet until after the holidays. The fact is, manufacturing has been somewhat overdone, which has resulted in the temporary depression in business.

The manufacturers of india-rubber goods have advanced prices from10 to 15 per cent. in consequence of the present high prices of raw material, caused by the manipulations of speculators. The prices of set screws and cap screws have been reduced from 5 to 8 per cent.

Iron and Metal Review.

This week there are unmistakable evidences of an easier tendency of the Pig Iron Market. We quote prices as follows: Foundry No. 1, $25.50 to $27. Foundry, No. 2, X, $23.50 to $25. There is a moderate demand for Foreign Iron with sales small. We quote Coltness, $27 to $27.50; Glengarnock, $24.75 to $25; Gartsherie, $26 to $26.50; Summerlee, $26 50; Carnbroe, $24.50; Eglinton, $23.50 to $24; Langloan, $26 to $26.50. Copper is in light demand at 18¼c. to 18 ¼c. Banca Tin 28c. Straits and Malacca 23¼c. to 23¾c.; Billiton 25¼c.; Australian 23c. to 23¼c.; English Lamb and Flag 23¾c.; Spelter 5¼c. to 5½c. for Common Domestic; Silesian 5.30c. to 5.37½c.; Lead 4.90c. to 4.95c.; Antimony, Hallets 10¾c.; Cooksons 12⅝c.; Nevada 12⅛c.

WANTED

"Situation and Help" Advertisements, 30 cents for each seven words (one line) each insertion. Copy should be sent to reach us not later than Thursday morning for the ensuing week's issue.

First-class pattern maker wants situation in city or vacinity on engine or pump work. Address Pattern Maker, box 379 South Norwalk, Conn.

Wanted—A permanent traveler to represent the Gardner Governor. Must be well posted. Address, R. W. Gardner, Quincy, Ill.

Mechanical draughtsman and superintendent with good practical experience, wants employment. X., care AMERICAN MACHINIST.

Wanted—Three first-class machinists and one good planer hand, who have worked on machine tools. Must be sober and steady men. None others need apply. Address, Jos. B. Reed, Cairo, Ill.

Wanted—A superintendent for iron works manufacturing engines, mining machinery, etc. Must be well up in engine work, sytematic and a driver. Address, stating experience and reference, Brown, office AMERICAN MACHINIST.

Draughtsman—Of theoretical knowledge and of long practical experience in the construction of marine and stationary engines, sugar plantation machinery and general mill work, is open for engagement; will go anywhere for a reasonable salary, and where engineering is wanted. Address, Draughtsman, AMERICAN MACHINIST.

Fine machinist wanted—An intelligent young man who is a first-class machinist, has some knowledge of draughting, can invent and construct special machinery, to make small articles in hardware, manage employes systematically and economically, is well recommended as to character and ability, is willing to work and learn, can find a place to work up by addressing, The Y. M. I. Co., Youngstown, O.

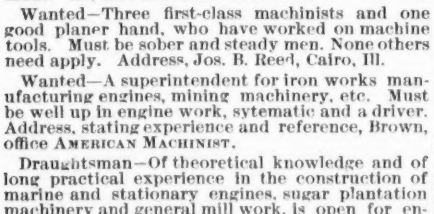
Situation wanted by a live machinist expert, as manufacturer of machinery. Is thoroughly acquainted with all the details of engine building both beam propeller, horizontal hoisting and other engines and machine work. Can furnish the highest reference from present position as to practical knowledge, designing, technical and executive ability. Or would take a position to represent some first-class machinery as Eastern agent. Address, Mechanic or Salesman, care AMERICAN MACHINIST.

Wanted—An active, energetic and competent practical machinist to take charge of a machine shop as foreman; class of work, the manufacture of wood-working machinery and general repairing. We want a thorough mechanic and one who understands taking charge of work and men. No others should apply. Must be active, industrious and sober. To such an one we offer good wages and prompt pay. References given and required. Address, Employer, No. 6 Franklin Avenue, Toledo, Ohio.

Wanted—500 feet of 42-inch diameter old boiler shells. Address, P. O. Box 1208, New Haven. Ct.

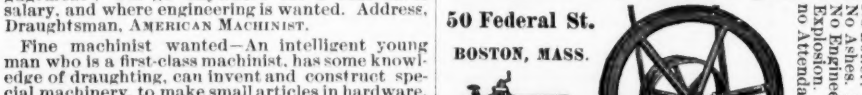
For sale—A Hittinger & Cook engine, 12x36, in good order. Apply at Hydraulic Works, VanBrunt street, South Brooklyn, New York.

Two Berryman Patent Feed Water Heaters.—One 36 inches diameter, 12 feet high, 9 inches exhaust; one 34 inches diameter, 9 feet high, 8 inches, exhaust. These heaters are only a short time in use, are in perfect order, and will be sold very cheap. Benj. F. Kelley, No. 20 Cortlandt street.



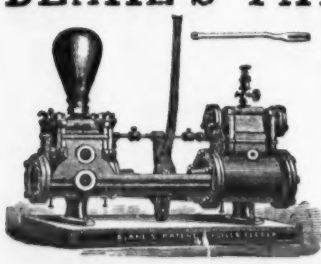
132 in. x 4 ft. TURRET LATHE.

Price $175. James Aitchison, 52 Canal St., Cleveland, Ohio.



CLEVELAND TWIST DRILL COMPANY, COX & PRENTISS, 24 & 26 West St., Cleveland, O.

BLAKE'S PATENT STEAM PUMPS.



MORE THAN 13,000 IN USE.

Adapted to Every Situation.

Send for New Illustrated Catalogue.

GEO. F. BLAKE MANF'G CO.

88 Liberty Street, NEW YORK. | 44 Washington St., BOSTON.

Second Annual Exhibition Fair

OF THE

New England Manufacturers' and Mechanics' Institute

IS NOW OPEN IN BOSTON.

The largest exhibition building in the United States. Ten acres of industrial exhibits, displaying the wonders of mechanism, Science and Art. The largest display of Machinery since the CENTENNIAL, all in operation, and showing the processes of manufacture **Carpet Weaving, Cotton Weaving, Silk Weaving.** The great railroad display of Atlanta duplicated. The leading industries of the North, South, East and West fully displayed, making a NATIONAL EXHIBITION.

DON'T FAIL TO VISIT THE EXHIBITION FAIR.

The Greenfield Vertical Engine,

SOLD BY **COOKE & CO.,** FORMERLY COOKE & BEGGS,

Dealers in

MACHINERY AND SUPPLIES,

6 Cortlandt St.

NEW YORK,

Is the Best in the market. Send for our prices before ordering Engines, Boilers, or other machinery.

AGENTS FOR

ROOTS' BLOWERS,
WATSON'S FORGES,
WATERS' GOVERNORS,
KEYSTONE INJECTORS,
Etc.

TO PAYMASTERS, Belcher's Paymaster's Assistant shows, at one glance, the amount of men's wages for quarter, half, three-quarters and even hours at all the ruling rates per hour. For ex.: 56¾ hours at 23½c. shows in one amount. $13 24. Price $2.00 by mail or express, C. O. D. Send for circular with first-class references. Address

E. W. BELCHER,
Box 47, Glenwood, Mass.

THE BRAYTON PETROLEUM ENGINE CO.

50 Federal St.

BOSTON, MASS.

No Boiler. No Coal. No Steam. No Ashes. No extra Insurance. No Engineer. No Danger. No Explosion. No Fires. Almost no Attendance.

SAFETY! ECONOMY! CONVENIENCE!

Expense Ceases when Engine is Stopped.

When power is required at intervals it is the cheapest Motor known.

JEROME B. SECOR,

MANUFACTURER OF

Machinery and Tools,

IMPROVED WIRE FEED SCREW MACHINES, GUN AND SEWING MACHINE TOOLS, DIES FOR DRAWING, FORGING, BLANKING, &c., MADE TO ORDER.

Manufacturer of

THE SECOR SEWING MACHINE,

Factory Cor. Broad & Railroad Ave.

BRIDGEPORT, CONN.

W. H. WARREN, WORCESTER, MASS.

Manufacturer of

12 Inch Stroke Traverse Head Shapers.

Five Foot Radial Drills as specialties.

"THE DEANE" STEAM PUMPS FOR EVERY SERVICE.

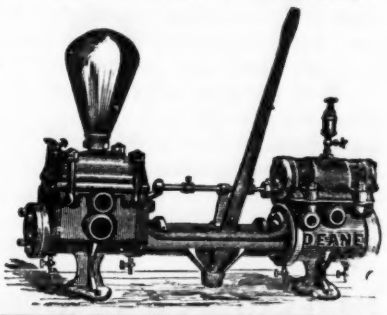
Send for New Illustrated Catalogue.

:o:

The Deane Steam Pump Co.

HOLYOKE, MASS.

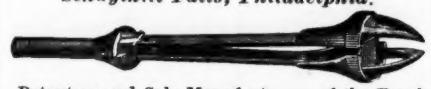
92 & 94 Liberty St., New York. 54 Oliver St. Boston. 226 & 228 Lake St., Chicago.



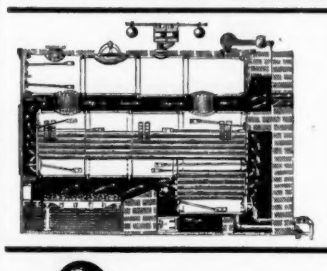
WE CHALLENGE THE WORLD FOR ITS EQUAL

RUFFNER & DUNN,

Schuylkill Falls, Philadelphia.



Patentees and Sole Manufacturers of the Excelsior Steel Tube Cleaners. $1 00 per inch. Most liberal discounts to dealers. Send for circular.



WM. T. BATE & SON,

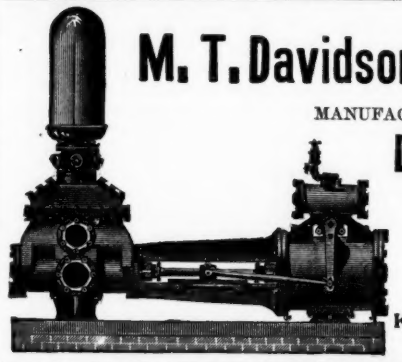
CONSHOHOCKEN, PENNA.

Manufacturers of

Bate's Patent Steam Generator.

THE MOST ECONOMICAL, RELIABLE AND DURABLE.

A large number of these boilers in use in the best establishments and institutions, showing **Splendid Results** in the way of economy, efficiency, durability and convenience of cleaning. We refer to parties using. Write for particulars.



THE

M. T. Davidson Improved Steam Pump,

MANUFACTURED BY

Davidson Steam Pump Co.,

OFFICE & WORKS:

41 to 47 KEAP STREET, BROOKLYN, N. Y.

Warranted the Best Pump made for all Situations.

KELLY & LUDWIG, Agents, 49 and 51 North 7th St., Phila., 97 Liberty Street., New York.

Weston's Differential Pulley Blocks,

CAPACITIES FROM ½ TON TO 10 TONS.

ONE MAN CAN LIFT 5,000 POUNDS.

THEY HOLD THE LOAD SUSPENDED AT ANY POINT.
ALL SIZES IN STOCK.

THE YALE LOCK MFG. CO.

Manufacturers, Engineers and Machinists,
PRINCIPAL OFFICE AND WORKS, STAMFORD, CONN.

SOLE MAKERS.

SALESROOMS:

NEW YORK—53 Chambers St. PHILADA.—507 Market St.
BOSTON—224 Franklin St. CHICAGO—64 Lake St.

40 page Catalogue of Light Hoisting Machinery furnished on application.

DIRECT BLOCK. GEARED BLOCK.

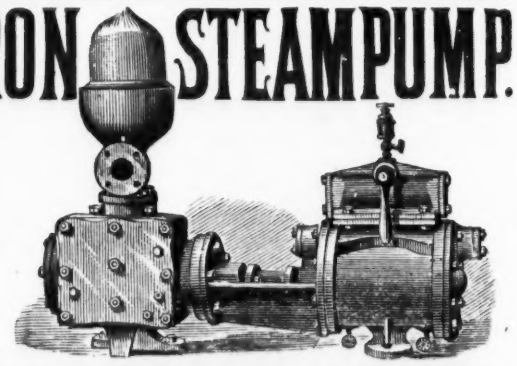
THE CAMERON STEAMPUMP.

Is the Standard of Excellence

AT HOME AND ABROAD.

THE A. S. CAMERON STEAM PUMP WORKS,

Foot of East 23d Street, New York.



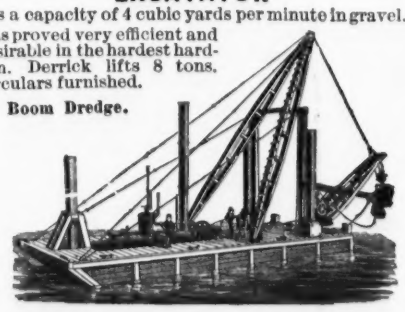
DREDGES

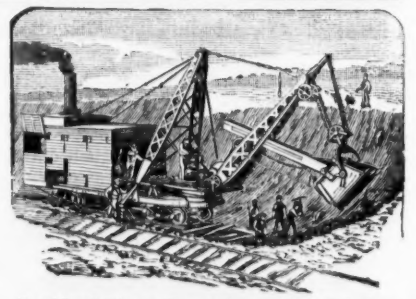
guaranteed to excavate 50 per cent. more material from hard bottom than any other machine.

EXCAVATOR

has a capacity of 4 cubic yards per minute in gravel. Has proved very efficient and desirable in the hardest hard-pan. Derrick lifts 8 tons. Circulars furnished.

Boom Dredge.





Combined Steam Excavator and Derrick Car.

OSGOOD & MACNAUGHTON,

ALBANY, N. Y., Patentees,

Successors to RALPH R. OSGOOD, Troy, N. Y.

NICHOLSON FILE CO.,

SOLE MANUFACTURERS OF

FILES AND RASPS

HAVING THE INCREMENT CUT.

Also, FILERS' TOOLS AND SPECIALTIES.

"Nicholson File Co's" Files and Rasps, "Double Ender" Saw Files, "Slim" Saw Files, "Racer" Horse Rasps, Handled Rifflers, Machinists' Scrapers, File Brushes, File Cards, Surface File Holders, Vise File Holders, Stub Files and Holders, Improved Butchers' Steels

Manufactory and Offices at PROVIDENCE, R. I.- U. S. A.

HENRY S. MANNING. EUGENE L. MAXWELL. CHARLES A. MOORE.

MANNING, MAXWELL & MOORE,

MANUFACTURERS OF AND DEALERS IN ALL KINDS OF

Railway and Machinists' Tools and Supplies,

No. 111 LIBERTY STREET, NEW YORK.

AGENTS FOR

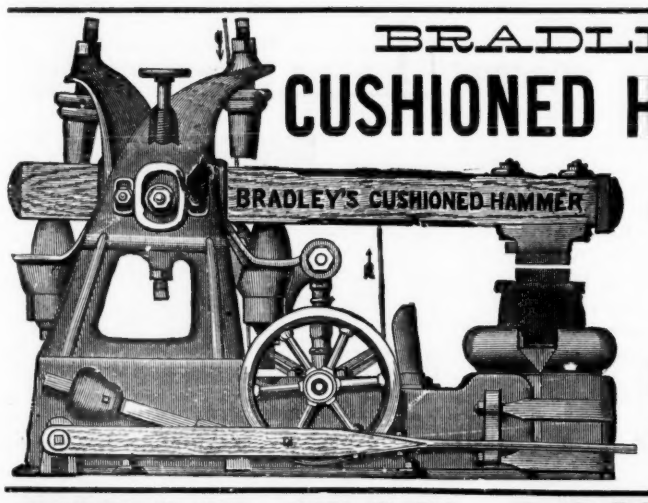
The Consolidated Safety Valve Co.
Morse Twist Drill and Machine Co.'s Taps, Dies, Screw Plates, &c.
The Hancock Inspirator Co.
Worcester Machine Screw Co.
Brady's Emery Grinding Machinery.
H. B. Bigelow & Co.'s Engines and Boilers.
Smith's Hub Friction Clutches.
Keystone Portable Forge Co.
Huntington Track Gauges.

AGENTS FOR

Midvale Steel Co.'s Tires, Axles, Forgings and Castings.
Saunder's Corrugated Copper Packing and Gaskets.
Hoopes & Townsend's Nuts, Bolts, Washers, Lag Screws and Rivets.
Betts Machine Co.'s Gauges, &c.
Niles Tool Works, Machine Shop and Car Tools.
Westcott's Lathe and Drill Chucks.
H. B. Smith Machine Co.

BRADLEY'S

CUSHIONED HAMMER



STANDS TO-DAY

WITHOUT AN EQUAL.

OVER 700 IN USE.

BRADLEY & CO.

SYRACUSE, N. Y.

[Established 1832.]

AKRON IRON COMPANY,

AKRON, O.

PATENT HOT POLISHED SHAFTING.

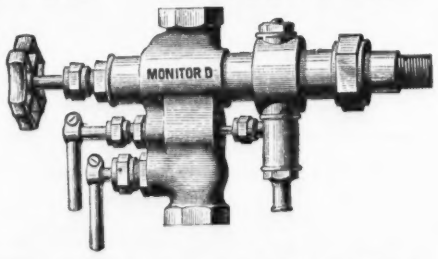
Superior to any shafting in market for the following reasons, viz.: 1st.—It is perfectly straight and round. 2d.—It can be rolled accurately to any desired gauge. 3d.—It has the beautiful blue finish of Russia Sheet Iron, rendering it less liable to rust or tarnish than shafting of the ordinary finish. 4th.—It will NOT SPRING or WARP IN KEY SEATING like most of the other manufactured shafting sold in the market, and, as a consequence, is admirably adapted for LINE AND COUNTER SHAFTING. 5th.—The surface is composed of MAGNETIC OXIDE OF IRON, forming a superior journal or bearing surface. 6th.—It is made of superior stock.

Sizes made from 7/8 to 3 15/16 inches, advancing by sixteenths. Price lists, with references and other information, furnished on application to

AKRON IRON CO., Akron, O., Sole Manuf'rs.

Or **E. P. BULLARD, 14 Dey Street, New York,** General Eastern Agent.

THE "MONITOR."



A NEW LIFTING & NON-LIFTING INJECTOR.

BEST BOILER FEEDERS IN THE WORLD.

FRIEDMANN'S

Patent Ejectors.

OR

WATER ELEVATORS,

For Conveying Water and Liquids

Pat. Oilers & Lubricators, &c.

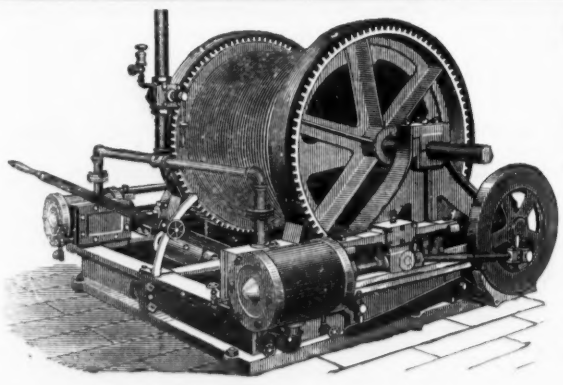
NATHAN & DREYFUS,

Patentees and Manufacturers,

92 and 94 Liberty Street,

NEW YORK.

Send for Illustrated Catalogue.



Improved Hoisting Engines

Specially adapted for

MINING PURPOSES.

ALL SIZES.

With Reversible Link Motion, or Patent Friction Drum.

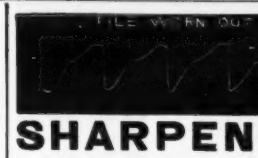
Manufactured by the

LIDGERWOOD MF'G CO.

Offices and Salesroom: 96 Liberty Street, N. Y.

Works: Partition, Ferris, and Dikeman Streets, Brooklyn.

G. S. WORMER & SONS, Agents, Chicago, St. Louis & Detroit.



PROCESS

FOR

SHARPENING FILES BY SANDBLAST

SAND BLAST FILE SHARPENING CO., Wilmington, Del.

WORCESTER MACHINE SCREW CO.

AND 111 LIBERTY ST. NEW YORK

MANUFACTURERS OF

STANDARD MACHINE SCREWS.

CLARK'S COMBUSTION OF FUEL.

Fuel: Its Combustion and Economy, consisting of Abridgments of Treatise on the Combustion of Coal and the Prevention of Smoke. By C. W. Williams; and the Economy of Fuel, by T. S. Prideaux, with extensive additions on recent practice in the Combustion and Economy of Fuel: Coal, Coke, Wood, Peat, Petroleum, &c. By the editor, D. Kinnear Clark, C. E. 12mo, cloth. $1.50.

D. VAN NOSTRAND,

23 Murray and 27 Warren Streets, N. Y.

*Copies sent by mail, postpaid, on receipt of price.

CHARLES MURRAY,

Engraver on Wood,

58 ANN ST. NEW YORK.

C. W. LE COUNT, South Norwalk, Conn.

LE COUNT'S HEAVY STEEL DOG,

With Steel Screws. Lathe Made and Hardened.

This dog is very heavy, and is warranted not to break with any work

No. 1	3-8 in.		$ .50
" 2	1-2 "		.60
" 3	5-8 "		.70
" 4	3-4 "		.70
" 5	7-8 "		.80
" 6	1 "		.80
" 7	1 1-8 "		.95
" 8	1 1-4 "		.95
" 9	1 3-8 "		1.10
" 10	1 1-2 "		1.10
" 11	1 3-4 "		1.25
" 12	2 "		1.40
" 13	2 1-4 "		1.60
" 14	2 1-2 "		1.60
" 15	3 "		1.80
" 16	3 1-2 "		2.00
" 17	4 "		2.30
" 18	4 1-2 "		3.00
" 19	5 "		3.50

Full set, 19 Dogs, 26.35

No. 20	5 1-2 in.		4.25
" 21	6 "		5.00

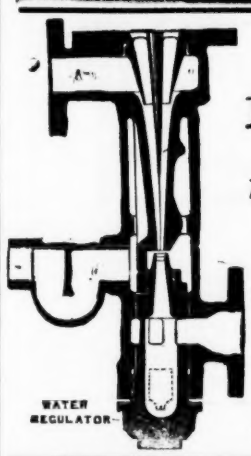
When ordering, state as above, whether a full set or a set of 12 or smallest of 8. Users of these dogs prefer them to any other make.

No 1	3 8 in.		$ .50
"	1-2 "		.60
" 4	3-4 "		.70
" 6	1 "		.80
" 8	1 1-4 "		.95
" 10	1 1-2 "		1.10
" 11	1 3-4 "		1.25
" 12	2 "		1.40

Small set of 8 dogs from 3-8 to 2 ins., $7.50.

No. 14	2 1-2 in.		$1.60
" 15	3 "		1.70
" 16	3 1-2 "		2.00
" 17	4 "		2.30

Set of 12 from 3-8 to 4 inches, $15.00.



ESTABLISHED 1880.

SCHAFFER & BUDENBERG,

NEW INJECTOR

Worked by Exhaust Steam Alone.

Takes the place of Feed Pump, Heater, and by Condensing the Exhaust Steam removes the Back Pressure.

UTILIZES A POWER HERETOFORE THROWN AWAY.

Works automatically at a steam pressure of less than half a pound. Adapted to all pressures.

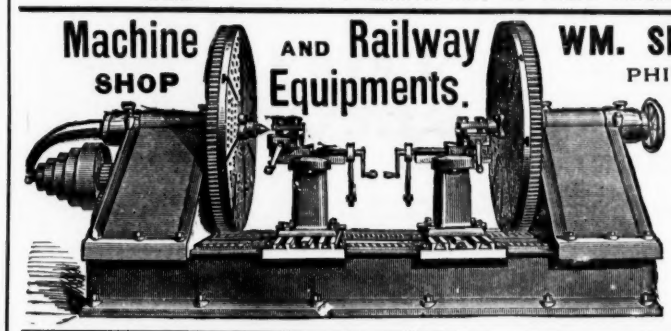
For LOCOMOTIVES as well as STATIONARY ENGINES.

WORKS AT BUCKAU,—GERMANY.

DEPOT GENERAL OF THE UNITED STATES,

W. HEUERMANN, 40 JOHN STREET, NEW YORK.

Machine SHOP AND Railway Equipments.



WM. SELLERS & CO.

PHILADELPHIA.

Shafts, Couplings, Hangers, Pulleys, Mill Gearing, etc., Lathes, Planers, Drills, Shapers, Bolt Cutters, Twedell's Hydraulic Riveters, etc. Railway Turntables and Pivot Bridges. Gifford Injectors, Sellers' Improvements. New Patterns. Simple. Effective.

New York Office,

79 LIBERTY ST.

THE HENDEY MACHINE CO.

TORRINGTON, CONN.

15, 24 and 30 in. shapers.

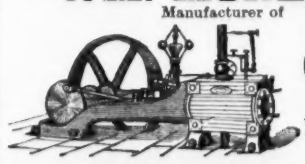
4 ft. x 16 in., 5 ft. x 20 in., 6 ft. x 24 in., 6 ft. x 26 in., 8 ft. x 26 in. and 8, 10, and 12 ft. x 30 in. Planers.

5 ft. x 12 in., 6 ft. x 12 in., 6 ft. x 15 in. and 8 ft. x 15 in. Hollow Spindle Hand Lathes.

AMATEURS' HAND PLANERS, SHAPER AND PLANER CENTERS, SLIDE RESTS, &c.

WM. MÜNZER,

Manufacturer of



IMPROVED CORLISS ENGINE.

1st Av. cor. 30th St. New York.

NUT TAPPING MACHINE.

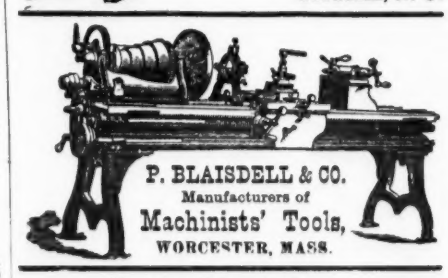
DURRELL'S PATENT.

No. 1 Machine, 900 lb., 7 spindles.
" 2 " 1,050 " 7 "
" 2 " 600 " 3 "

Capacity of 7 Spindles, 8,000 per 10 hours. Acknowledged to be an indispensable tool. Manufactured by

HOWARD BROS.,

Fredonia, N. Y.



P. BLAISDELL & CO.

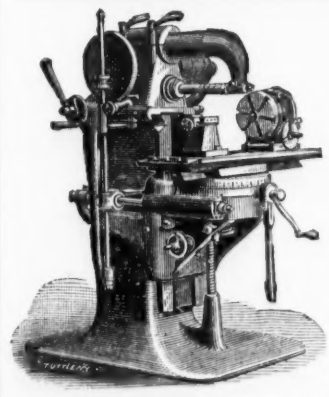
Manufacturers of

Machinists' Tools,

WORCESTER, MASS.

"PATENT BINDER"

For the AMERICAN MACHINIST holds 53 weekly issues in good shape. Sent to any address by mail for one dollar. **American Machinist Publishing Co.,** 96 Fulton Street, New York.



New Heavy Universal Milling Machine.

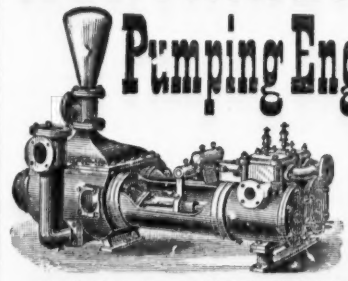
Correspondence solicited.

MANUFACTURED BY

C. E. LIPE, Syracuse, N. Y.

WORTHINGTON

Pumping Engines



AND

STEAM PUMPS.

HENRY R. WORTHINGTON.

239 Broadway, New York.
70 Kilby St., Boston. | 707 Market St., St. Louis

Send for Latest Catalogue.

TESTIMONIAL

OF THE MERITS OF THE

HANCOCK INSPIRATOR.

AUBURN, N. Y., July 24, 1882.

HANCOCK INSPIRATOR CO.,

35 Beach St., Boston, Mass.

DEAR SIRS:

It gives us pleasure to say to you that we have used your No. 10 Inspirator exclusively for the past two years, on our portable boilers, and we pronounce them the best boiler feeder for portable use we have ever seen. We have never had any complaints from our customers; on the other hand, they prefer them to anything else. We are using your Locomotive Inspirators with equal success on our Traction Engines.

Yours Respectfully,

THE E. M. BIRDSALL CO.

This Company are using over 300 No. 10 Inspirators this year.

THE E. HORTON & SON CO.

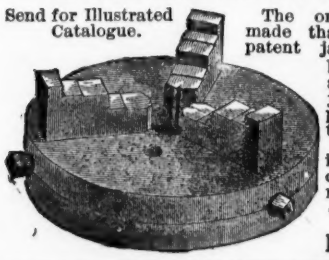
Canal St., Windsor Locks, Conn., U. S. A.

Only Manufacturers of the

HORTON Lathe and Car Wheel CHUCKS.

CAR WHEEL CHUCKS FROM 30 TO 42 INCH.

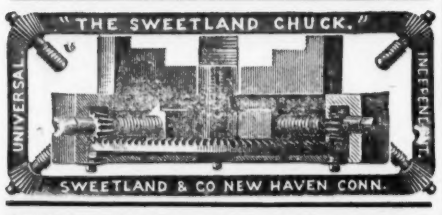
Send for Illustrated Catalogue.



The only chucks made that use the patent jaw, with both face and bite of jawsground perfectly true. None genuine without our trade-mark "The Horton Lathe Chuck."

T. NEW'S PREPARED ROOFING.

For steep or flat roofs. Applied by ordinary workmen at one-third the cost of tin. Circulars and samples free. Agents Wanted. T. NEW, 38 John Street, New York.



WOOD-WORKING MACHINERY.

Universal Wood Workers, Planing, Matching, Moulding, Band and Scroll Sawing Machines, Carriage, Wagon and Wheel Machinery, etc.

BENTEL, MARCEDANT & CO.,
HAMILTON, OHIO, U. S. A.

THE GARDNER COMPENSATION GOVERNOR

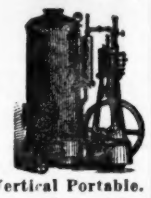
Unequaled for accuracy, safety, convenience, durability, workmanship, and design. Address

ROBERT W. GARDNER,
QUINCY, ILL.

New York Agents, JAMES BEGGS & CO., No. 9 Dey Street.

PAYNE'S AUTOMATIC ENGINES,

Established 1840.



Spark Arrester. Vertical Portable.

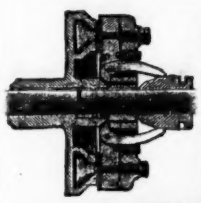
Reliable, durable and economical. *will furnish a horse power with ⅛ less fuel and water than any other engine built*, not fitted with an automatic cut-off. Send for illustrated Catalogue *c. c.*, etc. for information and prices. **B. W. PAYNE & SONS,**

Box 1230. CORNING, N. Y.

HOISTING ENGINES AND ELEVATORS.

Safe, Durable and Reasonable in Price.

Friction Clutch Pulleys and Cut-off Couplings.



We manufacture the "Giant Friction Clutch Pulley," known as the "Captain." **Is the Best in the World** for connecting the gearing of calender rolls, hoisting coal, logs or freight. Our Clutch can connect any amount of power, at any speed, without slacking the motive power in the least, and gives no shock, is easy to ship and unship, in fact, this is the only Clutch that can do heavy work satisfactorily.

D. FRISBIE & CO.

481 North Fifth Street, Philada., Pa.

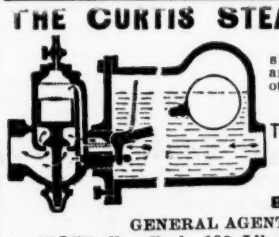
THE ALLIGATOR WRENCH,

Patented Aug. 31, 1875.

Teeth cut diagonally. Grips Round Iron or Pipe.

AMERICAN SAW CO.
TRENTON, N. J.

THE CURTIS STEAM TRAP.



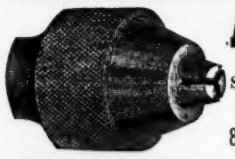
Send for Circular stating advantages and superiority over other traps.

Manufactured by

THE CURTIS REGULATOR CO.
51 Beverly St.
BOSTON, MASS.

GENERAL AGENTS:

A. ALLER, New York, 109 Liberty St.
JOHN McKAY, JR., Philada., 135 North 3d St.
EDW'D J. MOORE, Baltimore, 8 South St.



Almond Drill Chuck.

Sold at all Machinists' Supply Stores.

T. R. ALMOND,
84 Pearl St., Brooklyn, N.Y

HOLLAND

LUBRICATOR

For lubricating the valves and cylinders of steam engines. Operating with **Downward Visible Drop.** The principle of the Lubricator is entirely new, being the only one manufactured operating with a downward visible drop, and does not conflict with any other Patented Lubricator.

Protected with Letters Patent, granted July 5, 1881.

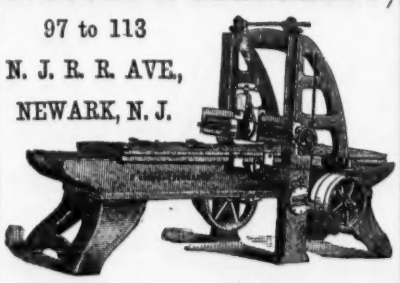
A saving of from 50 to 90 per cent. in cost of oils.

For sale by the Manufac'rs,

Holland & Thompson,
TROY, N. Y.

E. GOULD & EBERHARDT,

97 to 113
N. J. R. R. AVE.,
NEWARK, N. J.

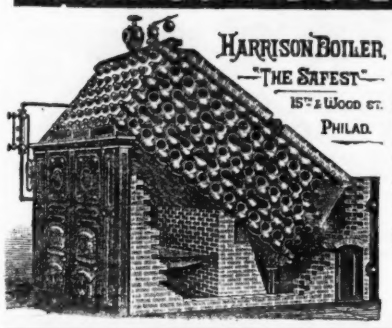


First-Class Planers.

22 x 22 x 5 feet	Weight,	3,500
26 x 26 x 6 "	"	5,500
26 x 26 x 8 "	"	5,800

Builders of Machinists' Tools.

HARRISON BOILER. "THE SAFEST"



Adapted for all Steam Purposes.

Merits have been proved during ten to fifteen years constant use by such concerns as Cheney Bros., South Manchester, Conn; Wallace & Sons, Ansonia, Conn.; Wampanoag Mills, Weetamoe Mills, Sagamore Mills, Fall River, Mass.; Sears' Building, Boston, Mass.; Brown & Sharpe Mfg. Co., Providence, R. I.; A. T. Stewart & Co., Tiffany & Co., New York; Stevens' Institute, Hoboken, N. J.; Matthiessen & Wiecher's Sugar Refinery, Jersey City, N. J.; Wm. Sellers & Co., S. S. White, Daniel Allen, Jno. Gardiner & Co., Phosphor-Bronze Smelting Co., Henry Bower, Evening Bulletin, Saturday Night, Philadelphia, Pa., and numerous others.

Franklin Institute Medal awarded for SUPERIORITY OF EVAPORATIVE EFFICIENCY, ECONOMICAL CAPACITY FOR GENERATING STEAM AND DYNAMIC VALUE OF STEAM. Easily transported on mule back. Send for Descriptive Catalogue.

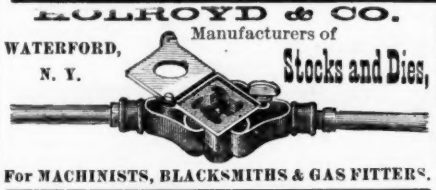
HARRISON BOILER WORKS
Germantown Junction, Philadelphia, Pa.

HOLROYD & CO.

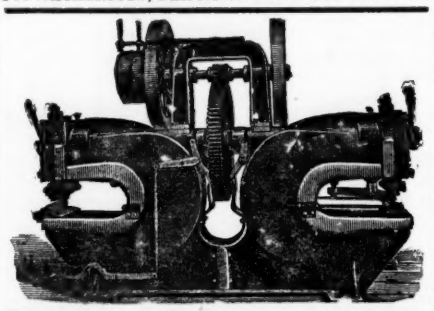
WATERFORD, N. Y.

Manufacturers of

Stocks and Dies,



For MACHINISTS, BLACKSMITHS & GAS FITTERS.



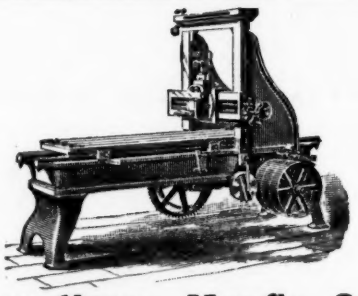
POWER PUNCHES, SHEARS, HAMMERS.

We make over 100 sizes of Punches and Shears, Double and Single, varying from 500 to 36,000 pounds in weight, and adapted for every variety of work The Double machines are equal to two Single ones as each side is worked independently. Also

ADJUSTABLE HELVE CUSHIONED HAMMERS

Of all sizes, unequalled for efficiency and durability.

The Long & Allstatter Co.,
HAMILTON, OHIO.



New Haven Manf'g Co.

NEW HAVEN, CONN.

IRON-WORKING MACHINERY

THE

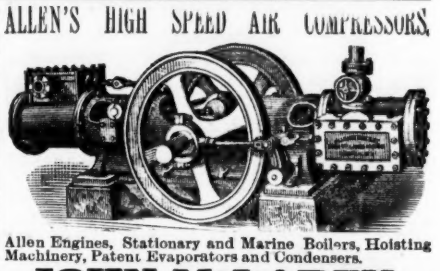
Slate Sensitive Drill.

Adapted to rapid work with small drills. Its extreme sensitiveness prevents clogging and breakage of drills. Has a swinging table with attachment for center drilling. Instantly adjustable to different lengths of work. Over 200 already in use. Send for circular

DWIGHT SLATE,

HARTFORD, CONN

ALLEN'S HIGH SPEED AIR COMPRESSORS.



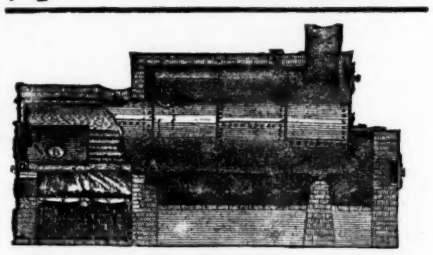
Allen Engines, Stationary and Marine Boilers, Hoisting Machinery, Patent Evaporators and Condensers.

JOHN McLAREN,
RIVER STREET, HOBOKEN, N. J.

MACHINERY FOR REDUCING AND POINTING WIRE

by compression or swaging **COLD.** Machines manufactured under patents owned by Miller, Metcalf & Parkin, Pittsburgh, Pa. For machines or information, address

S. W. GOODYEAR,
WATERBURY, CONN.



BRIDGEPORT BOILER WORKS,

BRIDGEPORT, CONN.

LOWE & WATSON, Proprietors,

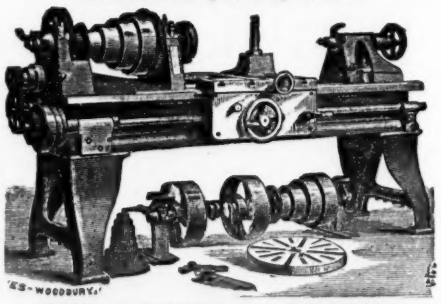
MANUFACTURERS OF

The Lowe Patent Tubular Boiler, with and without Superheating Drums. Fourteen years' use proves them the most durable and reliable boiler known. Gives dry steam. The process for combustion of the gases is in the construction and setting. Burns any fuel; obtains as much result from it as any boiler or setting with no more cost, and greater durability.

Send for descriptive Circular.

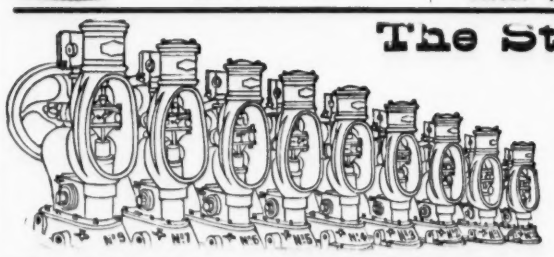
A. M. POWELL & CO.,

WORCESTER, MASS, U. S. A.



IRON WORKING MACHINERY.

The Steam Pumps



Made by VALLEY MACHINE CO., Easthampton, Mass., are the Best in the World for Boiler Feeding and other purposes.

SCHUTTE & GOEHRING, Manufacturers of

KORTING'S DOUBLE TUBE INJECTOR.

OVER 30,000 IN USE.

THE LEADING BOILER FEEDER.

OPERATED BY ONE HANDLE.

WORKING UNDER ALL CONDITIONS.

WILL LIFT HOT WATER. POSITIVE IN ITS ACTION.

SEND FOR CIRCULAR.

OFFICES AND WAREROOMS:

12th and Thompson Sts., Philadelphia.
A. F. UPTON, 7 Oliver St., Boston.
POND ENGINEERING CO., 709 Market St., St. Louis
C. F. KENNEDY, 104 15th St., Denver, Col.
G. B. LOMBARD & CO., 1026 Fenwick St., Augusta, Ga.
A. ALLEN, 109 Liberty St., New York.
M. C. BULLOCK MFG. CO., 84 Market St., Chicago.
GEORGE A. SMITH, 1419 Main St., Richmond, Va.
H. P. GREGORY & CO., 2 California St., San Fran'co.

MORSE TWIST DRILL & MACHINE COMPANY, NEW BEDFORD, MASS.

Sole Manufacturers of Morse Patent Straight-Lip Increase Twist Drill.

SOLID AND SHELL REAMERS, BEACH'S PATENT SELF-CENTERING CHUCK, BIT STOCK DRILLS

Drills for Coes, Worcester, Hunter and other Hand Drill Presses. Drill Grinding Machines, Center and Adjustable Drill Chucks, Taper Reamers, Milling Cutters, and Special Tools to order.

All Tools Exact to Whitworth Standard Gauges.

GEO. R. STETSON, Sup't. EDWARD S. TABER Pres't and Treas

A fire-proof non-conductor and deafener. 24 cents per cubic ft. at wholesale prices. Sample and circulars free by mail.

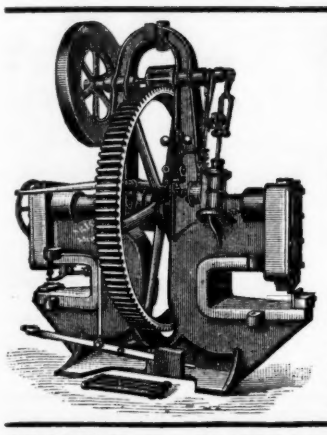
MINERAL WOOL.

Fibre Magnified.

X300

U. S. Mineral Wool Co.

22 Cortlandt Street, N. Y.



COMBINED PUNCH AND SHEAR,

BUILT BY

HILLES & JONES,

WILMINGTON, DEL.

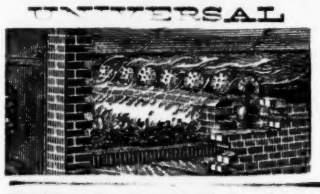
The annexed cut is taken from our No. 4 size with Engine attached for driving. Pulleys are in all cases supplied unless engine is especially contracted for. The Shear runs at all times when the belt is on the tight pulley, but the punch end can be stopped and started by a clutch, and for very particular work the hand wheel is used to set the punch to mark before throwing in the clutch. The stripper is adjustable to different kinds of iron. Either punch or shear supplied separately. FIVE sizes.

JOSEPH B. MATTHEWS, 41 Center Market Space, Baltimore, Md.

Manufacturer of the MATTHEWS

AUTOMATIC HIGH-SPEED ENGINE,

For Electric Lights and other purposes requiring steady, reliable power. The best and cheapest in the market. 25 H. P. for $500. Send for Circular.



PATENT FURNACE,

SAVES FUEL AND INCREASES BOILER CAPACITY.

CORRUGATED GRATE BARS,

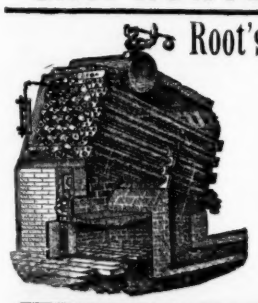
Suitable for Furnace Coal, Screenings, and all kinds of Waste Fuel.

JAMES MAHONY, 73 Astor House, New York.

FRICTION CLUTCH PULLEYS AND CUT-OFF COUPLINGS,

JAS. HUNTER & SON, North Adams, Mass.

Root's Wrought Iron Sectional Safety Steam Boiler.



ABSOLUTELY SAFE FROM EXPLOSIONS.

Unequaled in Economy of Fuel and Rapid Generation of Dry Steam.

All parts interchangeable. Easily erected in places inaccessible to other boilers. Altered or enlarged by any ordinary machinist. Shipped in packages weighing under 150 lbs. each. Low in price and first-class in material and workmanship.

OVER 260,000 H. P. IN USE FOR ALL PURPOSES.

Catalogues and **Conclusive References** mailed to any address. Drawings and full instructions for erection furnished with each boiler, making errors impossible.

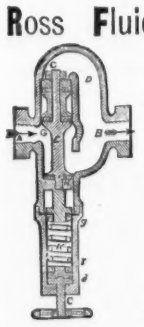
ABENDROTH & ROOT MFG. CO., 28 Cliff Street, New York.

AGENTS..... { ALEX. E. BROWN, 130 Water Street, Cleveland, Ohio. GEO. J. ROBERTS & CO., Dayton, Ohio.

MECHANICAL DRAWINGS.

Copies or Tracings of any class of machinery made and used in Europe. 2000 designs **WOOD & RICHMOND,** Mechanical Engineers and Draughtsmen, 176 Broadway, N. Y.

Ross Fluid Pressure Reducer,



For Steam, Water, Air & Gas.

Automatically reduces the pressure in pipes to any desired extent.

Manufactured by the

Ross Valve Co.

652 RIVER ST., TROY, N. Y.

Simplest! Cheapest! Best!

SEND FOR CIRCULAR.

For full description of this Valve see AMERICAN MACHINIST issue of March 11, 1882.

THOS. DANIEL, PATTERN MAKER

60 FULTON ST., NEW YORK.

Electrical and Intricate Core Work a Specialty.

TOOLS.

Machinists, Engineers, Model Makers and all classes of Mechanics can find TOOLS to suit them at

184 to 188 WASHINGTON STREET, BOSTON, MASS.

A. J. WILKINSON & CO.

CATALOGUES FREE.

DEAN BROS' STEAM PUMP WORKS,

INDIANAPOLIS, IND.

Boiler Feeders, Fire Pumps, Pumping Machinery for all purposes.

Send for Catalog

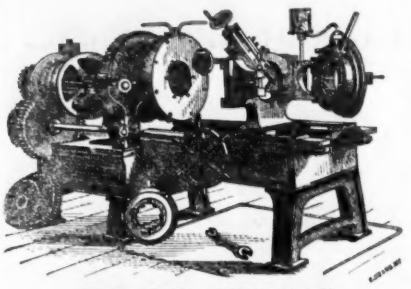
JARVIS PATENT FURNACE FOR SETTING STEAM BOILERS.

Economy of Fuel, with increased capacity of steam power. The same principle as the SIEMANS' PROCESS OF MAKING STEEL, utilizes the waste gases with hot air on top of the fire. Will burn all kinds of Waste Fuel without a blast, including screenings, wet peat, wet hops, sawdust, logwood chips, slack coal, &c.

Send for circular. **A. F. UPTON, General Agent,** 7 Oliver St. (P. O. Box 3401,) Boston, Mass.

BERTON & NICKEL, New York Agents, No. 92 Liberty Street.

POND ENGINEERING CO., Western Agents, 709 Market Street, St. Louis, And 130 W. Second St., Cincinnati, Ohio.



SEND FOR CIRCULAR.

D. SAUNDERS' SONS,

Manufacturers of

Pipe Cutting & Threading Machines

For Pipe Mill and Steam Fitters' Use.

TAPPING MACHINES,

For Steam Fitting, also

Steam and Gas Fitters' Hand Tools.

YONKERS, N. Y.

CLEM & MORSE,

413 Cherry Street, Philadelphia.

108 Liberty Street, New York.

Send for descriptive circulars.

FRANK THOMPSON,

Monitor, Hand, Speed and Back Geared

LATHES.

Slide Rests, Chucks and Brass Finishers Tools of the finest quality.

168 CENTRE STREET, N. Y. CITY.

PECK'S PAT DROP PRESS.

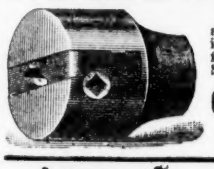
BLAST FORGES.

STEEL & IRON DROP FORGINGS.

Drop Dies and Special Machinery.

BEECHER & PECK, NEW HAVEN CONN.

THE REID DRILL CHUCK



The Strongest, most Simple and greatest capacity of any in the market. Sold by all first-class Machinists' Supply Stores. Manufactured by

CHAS. H. REID,

DANBURY, CONN.

---

20 INCH SWING ENGINE LATHES.

F. C. & A. E. ROWLAND, New Haven, Conn.

SHEFFIELD GRATE BAR.

For all kinds of Fuel. Send for Circular.

POND ENGINEERING COMPANY,

709 Market St., St. Louis, Mo.; 130 W. Second St., Cincinnati, O.; 88 Market St., Chicago, Ill.

Crosby's Improved "Pop" Safety Valve.

CROSBY STEAM GAGE & VALVE CO.

J. H. MILLETT, Pres't. GEO. H. EAGER, Treas.
GEO. H. CROSBY, Sup't. WALTER P. CLARK, Sec'y

Sole Proprietors and Manufacturers of **CROSBY'S**

Adjustable "Pop" Safety Valve.

Improved Steam Pressure Gage.

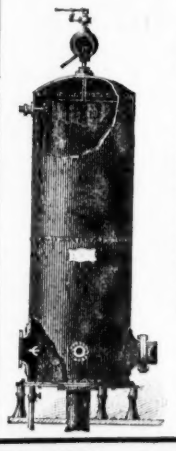
Self-Closing Water Gage.

Improved Steam Engine Indicator.

Sole Manufacturers and General Agents for The **"VICTORY"** Steam Cylinder Lubricator, "Single Bell Chime Whistle," "Bay State Steam Muffler," and all instruments for use on Steam Engines, Boilers, &c., send for particulars.

97 OLIVER ST., BOSTON, MASS.

THE BARAGWANATH S. J. F. W. H. & P.



Manufactured by the

Pacific Boiler Works

OF CHICAGO,

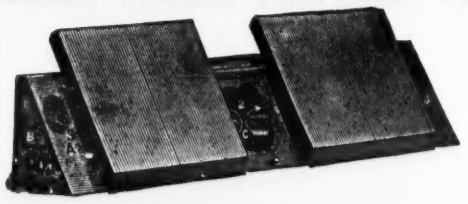
Has received unparalleled success in the West during the past five years. The most distinguished feature about this heater is its steam jacket, thus enabling it to accomplish the unprecedented result of almost invariably delivering the feed water several degrees above the boiling point, reducing back pressure on the engine, and keeping the boilers reasonably clean.

BENJ. F. KELLEY,

20 CORTLANDT ST., NEW YORK,

Gen. Eastern Agent.

JONES' PATENT FIRE-JAMB PLATES & BOILER SETTING.



Furnish permanent and perfect protection to the boiler front and supply heated air at the bridge wall to aid in combustion of gases.

Ask your Boiler Maker for it.

Manufactured by

Cohoes Iron Foundry and Machine Co.

COHOES, N. Y.

WOOD WORKING MACHINERY.

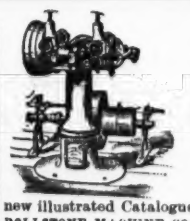
IRON TOOLS.

ENGINES & SUPPLIES.

H. B. SMITH MACHINE CO.

CORRESPOND WITH US 925 MARKET ST. PHILADELPHIA PA U.S.A.

AVAIL YOURSELF OF OUR LARGE STOCK



Power Machines,

Band Saws, Rotary and Stationary Bed Planers, and Buzz Planers, Jig Saws, Variety Moulding Machines, Wardwell's Patent Saw Bench, Pattern Makers' Lathe, Boring Machines, Waymouth Lathes and Gauge Lathes.

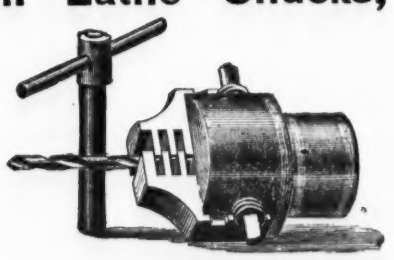
Also, a large stock of Second hand Machinery, consisting of Machinists' Tools, Woodworking Machinery and Engines and Boilers. Send Stamp for new illustrated Catalogue. Just out.

ROLLSTONE MACHINE CO., 45 Water St., Fitchburg, Mass.

Westcott's Combination Lathe Chucks,

Both Scroll and Geared.

Greater capacity. Jaws reversible. No projecting screws in the rim. Movements independent, universal and eccentric.

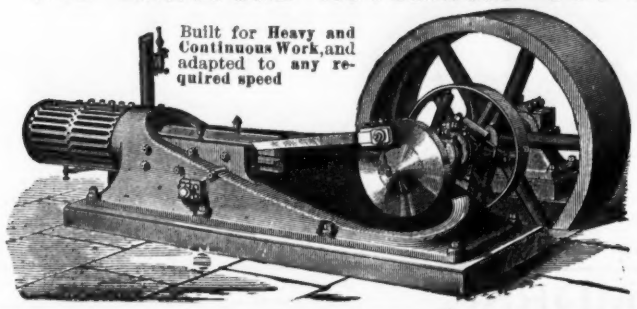


Oneida Steam Engine and Foundry Co.

ONEIDA, N. Y.

Send for circulars.

THE HARTFORD AUTOMATIC CUT-OFF ENGINE.



Built for **Heavy and Continuous Work**, and adapted to any required speed

Close regulation and best attainable **Economy of Fuel.** Circular and Practical Treatise on Steam Engineering sent on application.

The Hartford Engineering Company,

HARTFORD, CONN.

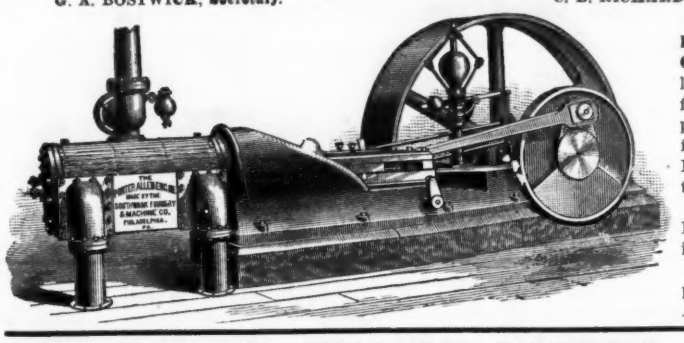
New York Office,
Rooms 72 and 73 Astor House.

Hill, Clarke & Co., Agents,
26 Oliver St., Boston.

THE PORTER-ALLEN HIGH SPEED ENGINE.

W. H. MERRICK, President and Treas.
G. A. BOSTWICK, Secretary.

C. T. PORTER, Vice-President.
C. B. RICHARDS, Superintendent.

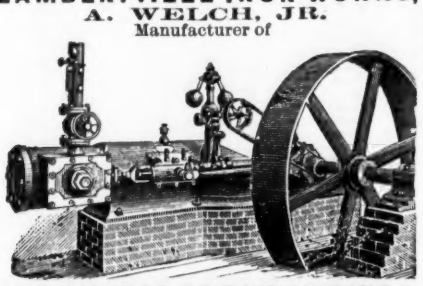


THE SOUTHWARK FOUNDRY & MACHINE CO., Philada., having largely increased its facilities is now prepared to fill all orders for the Porter-Allen Engine on contract time.

Orders solicited for Iron and Brass Castings in the rough.

Address the Company, 430 Washington Avenue, Phila., Pa.

LAMBERTVILLE IRON WORKS,
A. WELCH, JR.
Manufacturer of



AUTOMATIC STEAM ENGINES,
Also, Plain Slide Valve Engines.
Send for Circular. **LAMBERTVILLE, NEW JERSEY.**

F. W. MOSS,

80 JOHN ST., N. Y.

STEEL AND FILES,

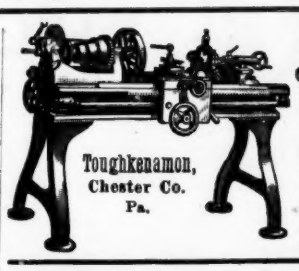
HAMMERS.

Warranted Cast Steel, for Dies, Punches, Drills, Turning Tools, Taps, Reamers, &c.

IMP'D MILD-CENTRED CAST STEEL
For Taps, Reamers, &c.

W. C. YOUNG & CO., Worcester, Mass.
Manufacturers of
ENGINE LATHES, HAND LATHES,
Foot Power Lathes, Slide Rests, &c.

J. ASHTON HAND,
MAKER OF
FIRST-CLASS
Engine Lathes



Toughkenamon, Chester Co. Pa.

KENSINGTON ENGINE WORKS, (Limited,)

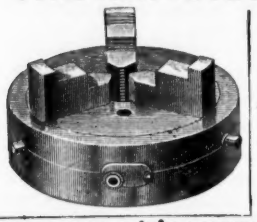
Vienna and Beach Sts., - - - PHILADELPHIA.
ENGINEERS AND MACHINISTS,
Manufacturers of

BUCKEYE AUTOMATIC ENGINES

For Middle and South Atlantic States.
SPECIAL MACHINERY BUILT TO ORDER.

H. C. FRANCIS, Manager. JOHN T. BOYD, Engineer. WM. L. SIMPSON, Supt.

"THE NATIONAL CHUCK"



WARRANTED SUPERIOR TO ANY CHUCK IN THE MARKET

NATIONAL M'F'G CO. NEW HAVEN, CONN

H. BICKFORD,

Manufacturer of

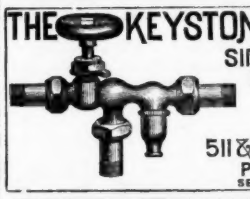
Drills

AN EXCLUSIVE
SPECIALTY.

N. W. Corner
Pike and Front Sts.

CINCINNATI, O.

THE KEYSTONE INJECTOR



SIMPLEST & BEST,
BOILER FEEDER
MANF'CD BY
E. TRACY
511 & 513 N. 12TH ST,
PHILADELPHIA PA.
SEND FOR CIRCULAR.

J. A. FAY & CO., CINCINNATI, Ohio, U. S. A.

BUILDERS OF IMPROVED

Wood-Working Machinery.

Embracing nearly 400 Machines for

Planing & Matching,

Surfacing, Moulding, Tenoning, Mortising, Boring, and Shaping, &c.

Variety and Universal

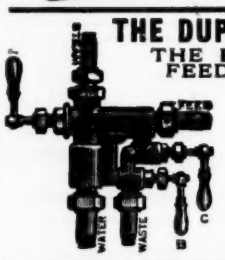
WOOD WORKERS.

Band, Scroll and Circular Saws, Resawing Machines, Spoke and Wheel Machinery, Shafting, Pulleys, etc. All of the highest standard of excellence.

W. H. DOANE, Pres't. D. L. LYON, Sec'y.

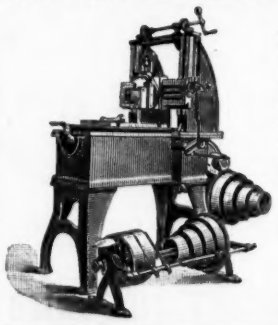
THE DUPLEX INJECTOR.

THE BEST BOILER FEEDER KNOWN.



Not liable to get out of order. Will lift water 25 feet. Always delivers water *hot* to the boiler. Will start when it is hot. Will feed water through a heater. Manufactured and for sale by JAMES JENKS, Detroit, Mich.

IMPROVED CRANK PLANER



Planes 16 inches high and wide, and has 12 inch stroke.

It has power, cross and angular down feed as shown in cut, or cross feed only, if desired.

Also, quick return motion and screw running whole length under bed.

It is self-oiling in its ways.

R. A. BELDEN & CO.

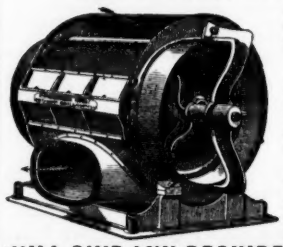
Danbury, Conn.

IMPROVED MACKENZIE BLOWER

MADE BY

SMITH & SAYRE MF'G CO.

245 Broadway, New York.



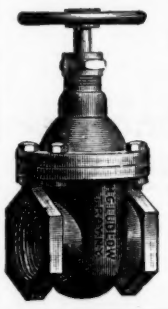
HAS NO EQUAL FOR A PRESSURE BLAST.

GIVES A DEFINITE QUANTITY OF AIR without reference to condition of Cupola.

SPEED AND POWER **LESS** THAN FOR ANY OTHER BLOWER.

WILL GIVE ANY REQUIRED PRESSURE
AT 50 to 100 REVOLUTIONS PER MINUTE.
SEND FOR PRICES.

Ludlow Valve Mfg. Co.



OFFICE AND WORKS:
938 to 954 RIVER ST.,
AND
67 to 83 VAIL AVE.
TROY, N. Y

VALVES—Double and Single Gate, ¼ in. to 48 in. outside and inside Screws, Indicator, etc., for Gas, Water and Steam.

Also,

FIRE HYDRANTS.

SEND FOR CIRCULAR.

Buffalo Cupola & Forge Blowers.

Warranted superior to any other make.

All sizes and styles for every class of work.

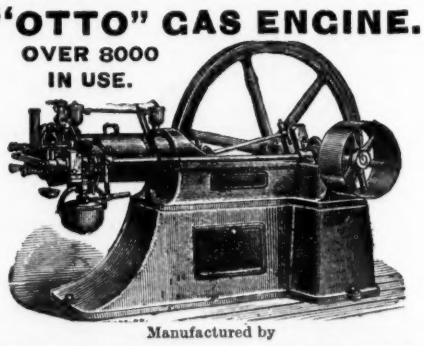
BUFFALO FORGE CO.

BUFFALO, N.Y.

Send for Catalogue and prices.

"OTTO" GAS ENGINE.

OVER 8000 IN USE.

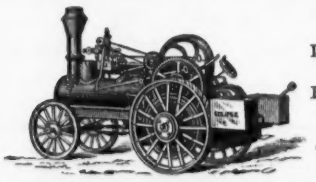


Manufactured by
SCHLEICHER, SCHUMM & CO., 33d & Walnut Sts., Philada.

STEAM PUMPS, AIR COMPRESSORS, Friction Hoisting Engines, Vacuum Pumps and Condensers, General Machinery, Steam Engines. Capacity to bore cylinders 210 in. diameter and turn Fly Wheels of 24 feet.

The Norwalk Iron Works Co.
SOUTH NORWALK, CONN.

ECLIPSE PORTABLE & TRACTION ENGINES



Stationary Engines.
Iron and Steel Boilers.
Portable Circular Saw Mills.
Threshers & Separators.

Send for Catalogue and say where you saw this.

FRICK & CO.

Waynesboro, Franklin Co., Pa.

BULKLEY CONDENSER,

For every class of Steam Engines, Steam Pumps, Vacuum Pans, &c.

Guaranteed to Save 20 to 25 per cent. of fuel, or gain 25 to 30 per cent. in power.

Send for pamphlets, prices, references, &c.

HENRY W. BULKLEY,

149 BROADWAY, N. Y.

SCHUTTE & COEHRING,
Manuf's of

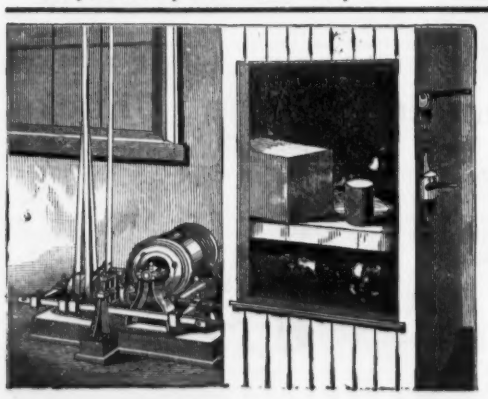
KORTING CONDENSER.

For Steam Engines and Pumps.

Requires no Air Pump and no foundations. Only 15 ft. height of water required from level of water supply to discharge pipe, instead of 34 ft., whether above or below engine cylinder. Has fewer parts, and is lower in price than any other condenser. Send for circular giving full information.

Offices and Warerooms:

12th and Thompson Sts., Philadelphia.
A. ALLER, 109 Liberty St., New York.
A. F. UPTON, 7 Oliver St., Boston.



Tewksbury Automatic Elevator Co.

MANUFACTURERS OF
PACKAGE AND LIGHT FREIGHT

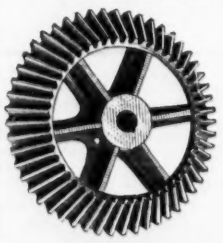
ELEVATORS

60 Temple Court, Beekman Street,
Send for Circulars. **NEW YORK.**

MACHINE MOULDED **GEARING,**

SHAFTING, PULLEYS, Etc.

In great variety of sizes. Castings or finished work furnished the trade at favorable prices.



ALSO,

LEFFEL TURBINE

Water Wheels.

POOLE & HUNT,

BALTIMORE, Md.

VOLNEY W. MASON & CO.
Friction Pulleys, Clutches and Elevators,
PROVIDENCE, R. I.

Hewes & Phillips' Iron Works,
Newark, N. J.

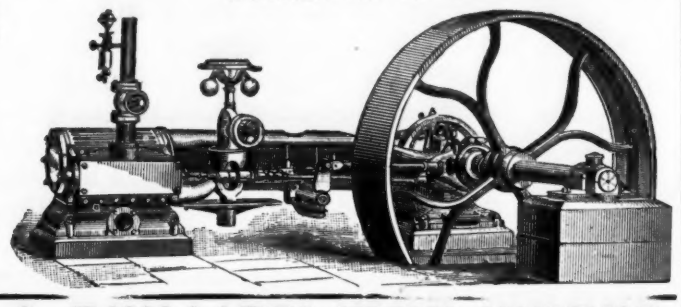
Manufacturers of
PLANERS,
LATHES,
GEAR CUTTERS,
SHAPERS,
SLOTTERS,
ALSO
Hydraulic Oil Presses & Veneer Cutting Machinery, Shafting & Gearing.
Heavy Planers a Specialty.
One 48"x48"x12' Planer and One 10 in. Slotter in stock.

WOODBURY, BOOTH & PRYOR,

Manufacturers of

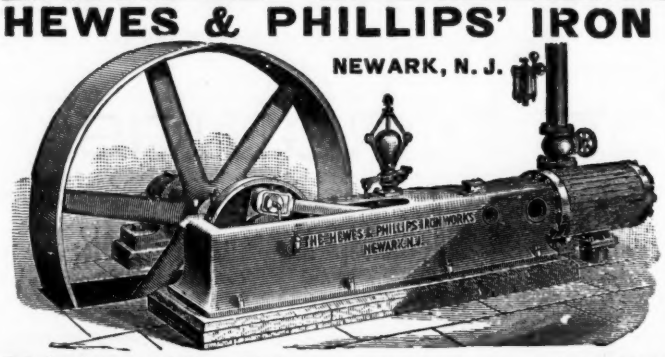
ROCHESTER N. Y.

Automatic Cut-Off,
Fixed Cut-Off,
and Slide Valve
STEAM
ENGINES,
Tubular Boilers.



HEWES & PHILLIPS' IRON WORKS,

NEWARK, N. J.



Manufacturers of

The ALLEN PATENT HIGH-SPEED ENGINE.

Both Condensing and Non-Condensing, especially designed and constructed for the Rolling and Cotton Mill Trade, and all establishments requiring an absolutely uniform and economical power.

Tubular Boilers and Steam Fittings. Contracts taken for complete Motive Power Outfits.

KELLY & LUDWIG, 49 & 51 N. SEVENTH ST. PHILADELPHIA, Pa.

NEW IRON WORKING MACHINERY On Hand or for Quick Delivery. *Write for prices and particulars.*

ENGINE LATHES.

38 inch, triple-geared (bed to suit).			Fitchburg.
28 inch swing,		18 foot bed.	Fitchburg.
26 "	"	18 "	Fitchburg.
24 "	"	14 and 16 "	Fitchburg.
21 "	"	12 and 14 "	Blaisdell.
20 "	"	14 "	Fitchburg.
20 "	"	12 "	Fifield.
19 "	"	10 and 12 "	Gray.
18 "	"	10 and 12 "	Blaisdell.
17 "	"	6 "	Johnson.
16 "	"	6 and 8 "	Fitchburg.
14 "	"	6 and 8 "	Fitchburg.
13 "	"	8 "	Blaisdell.

PLANERS AND SHAPERS.

30 inch x 30 inch x 8 foot,	Fitchburg.
25 inch x 25 inch x 8 foot,	Fitchburg.
36 inch x 36 inch x 9 ft., planer. 2d hand, good order	Wheeler.
26 inch x 24 inch x 6 and 7 ft. planer,	Wheeler.
22 inch x 20 inch x 4 ft. planer,	Wheeler.
18 inch x 18 inch x 3 foot planer,	Gould.
10 inch stroke shaper,	Fitchburg.
15 inch stroke crank planer.	Blaisdell
10 inch stroke shaper,	Gould.
12 inch stroke shaper,	Fitchburg.
15 inch stroke shaper.	Gould & Eberhardt.

DRILL PRESSES.

48 inch radial drill, self-feed, double gearing slotted and planed bed.	Betts.
30 inch, back-geared, automatic.	Prentice.
25 inch, back-geared, self-feed,	Fitchburg.
25 inch, quick return.	Blaisdell
19 inch, " "	Blaisdell.
18 inch, " "	Blaisdell & Fitchburg.

BRASS LATHES.

American Tool Machine Co's.
No. 2 Cabinet Turret Lathes, 6 ft. bed, 18 in. swing.
No. 1 Sq Arbor Fox Lathe, 5 ft. bed, 15 in. swing.
No. 2 & 3 Dove Tail Set-over Lathe, 5 ft. bed, 13 in. sw.
Sq. Arbor Fox Lathe, Gage.

2, 3, and 4 spindle drills, Garvin.
15 inch swing, 5 foot bed, Fox Lathe, Gage.
No. 2 (1/8-1/4) Bolt Cuttters, Merrimans.
Power and Hand Millers, Garvin.
12 inch slotter (swing 56 inch), Hewes & Phillips.

New & Second-Hand ENGINES, BOILERS,

Steam Pumps and Boiler Feeders,

MACHINERY, TOOLS & SUPPLIES

For Iron and Wood Workers.

Foot and Hand Power Machinery. Machinists' Hand Tools, &c., &c.

O. L. PACKARD,

85 & 87 WEST WATER STREET,

MILWAUKEE, WIS.

SEND FOR LIST OF

IRON WORKING MACHINERY

ON HAND,

NEW AND SECOND-HAND.

SPECIALTIES.

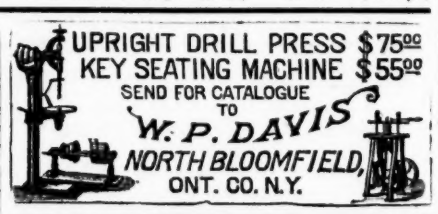
Extra Heavy Bridgeport 16 in. Swing Engine Lathes.

SECOR SCREW MACHINES.

WRITE FOR WHAT YOU WANT.

E. P. BULLARD,

14 DEY STREET, NEW YORK.



MACHINERY.

42 inch Swing,	16 foot Bed,	Engine Lathe.			New.
40 "	"	14 "	"	"	"
36 "	"	18x12 "	"	"	"
32 "	"	9 "	"	"	"
30 "	"	18-16-14&12 ft. beds	"	"	"
24 "	"	12 fo t Bed,	"	"	"
20 "	"	6&10 "	"	"	"
18 "	"	8x10 "	"	"	"
17 "	"	6 "	"	"	"
16 "	"	6&8 "	"	"	"

Large list of 2d-Hand Lathes, Various sizes & lengths.

38 inch x 38 inch x 12 foot Iron Planer.							New.
38 "	38 "	8 "	"	"	"	"	"
36 "	36 "	11 "	"	"	"	"	"
36 "	36 "	9 "	"	"	"	"	"
32 "	32 "	9 "	"	"	"	"	"
27 "	27 "	7 "	"	"	"	"	"
30 "	27 "	10 "	"	"	"	"	"

Shapers, Drills, Bor'g Mills, Cutting-off Machines, &c.

J. M. BADGER, 5 Dey St., N.Y.

CORLISS ENGINES FOR SALE.

PROMPT DELIVERY.

One 12 inch Cylinder. 36 inch Stroke. At once.
One 14 " 36 " In two weeks.

APPLY TO

THE GEORGE PLACE MACHINERY CO.

121 Chambers & 103 Reade Sts., New York.

HILL, CLARKE & CO.

36 OLIVER ST., BOSTON, MASS.

Branch Office, 800 North Second Street, St. Louis, Mo.

Machinists' Power Tools & Supplies.

LIST OF LARGE LATHES ON HAND.

One Gleason, Triple Geared, Screw-Cutting Engine Lathe, 40 inch swing, 16 foot bed.

One Fitchburg, Triple Geared, Screw Cutting Engine Lathe, 50 inch swing, 20 foot bed.

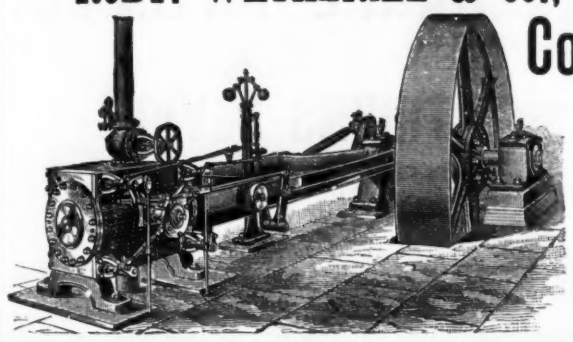
One Special Shafting Lathe, 28 inch swing, 25 foot bed, to take 20 feet between centers.

One Special Shafting Lathe, 26 inch swing, 25½ foot bed, to take 20 feet between centers.

PLANERS.

One Pond Planer, 26 in. x 26 in. x 8 ft. One Hendy Planer, 26 in. x 26 in. x 6 ft. One Gleason Planer, 36 in. x 36 in. x 8 ft.

ROBT. WETHERILL & CO., CHESTER, PA.



Corliss Engine Builders,

Condensing, Non-condensing, and Compound.

HIGHEST EFFICIENCY AND GREATEST ECONOMY.

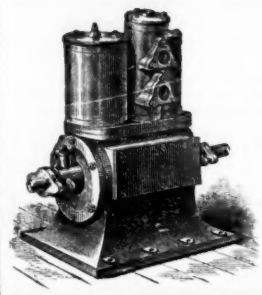
Boiler Makers.

Hydraulic Riveting.

GEORGE WESTINGHOUSE, Jr., Pres't. RALPH BAGALEY, Sec. & Treas. H. H. WESTINGHOUSE, Sup't.

The Westinghouse Engine,

2 to 150 HORSE POWER.



Is absolutely balanced at all speeds, and may be run from **300 to 1200 revolutions per minute.** Requires neither **Lining, Adjustment, Keying up, Packing, Lubrication or Wiping. SKILLED ENGINEERS ARE ENTIRELY DISPENSED WITH.** Is especially adapted to direct connection to high-speed machinery also, for all general purposes of belted power. Workmanship equal to the best machine tools. **All parts built strictly to gauge and interchangeable.**

DAMASCUS BRONZE.

A composition metal, unequaled in strength, durability, anti-friction qualities and price. Send for illustrated circular and price list.

THE WESTINGHOUSE MACHINE COMPANY,

Works at Pittsburg, Pa. 92 & 94 Liberty St., New York.

Fox Turret and Speed Lathes

— AND —

Swivel Head Engine Lathes,

(18 and 26 in. from new patterns.)

GEORGE GAGE, WATERFORD, N. Y.

New & Second-Hand Machinery.

NOV. 1, 1882.

1	Engine Lathe,	14 in. x 5, 6 & 7 ft.	Grant & Bogert.
1	" "	26 in. x 12 ft.	Grant & Bogert. [New
1	" "	22 in. x 14 ft.	" New.
1	" "	36 in. x 12, 17 ft.	New.
1	" "	42 in. x 14 ft.	New.
1	" "	40 in. x 16 ft.	Good order.
1	" "	32 in. x 8 ft	" "
1	" "	21 in. x 7 ft.	" " Pond.
1	" "	14 in. x 6 ft.	Star Tool Co. New.
1	" "	15 in. x 6 ft.	"
1	" "	14 in. x 5 x 6 ft.	"
1	" "	16 in. x 6, 7 & 8 ft.	Bridgeport. "
1	" "	13 in. x 5 ft & 6 ft.	Ames. "
1	" "	16 in. x6, 7 & 8 ft.	Ames. "
1	" "	18 in.x8 & 10 ft.	Lodge & Barker "
1	" "	24 in. x 12 ft.	Perkins "
1	" "	20 in. x 12 ft.	Fifield. New.
1	" "	28 in. x 16 ft.	New. Fifield.
1	" "	11 in. x 4 ft. & 5 ft.	Prentiss. New.
1	" "	11 in. x 4 ft.	New.
1	" "	12 in. x 5 ft.	Young. New.
1	Plain Engine Lathe,	16 in. x 4 ft.	"
1	" "	15 in. x 4 ft.	New.
1	Fox Lathe,	15 in. x 5 ft.	Am. Tool & Machine Co.
1	15 in. x 4 ft.	Turret Lathe.	Lodge & Barker.
1	Fox Turret Lathe,	16 in. x 6 ft.	Lodge & Barker. New.
1	Planer.	38 in. x 38 in. x 8 ft.	New.
1	"	36 in. x 36 in. x 18 ft.	"
1	"	36 in. x 36 in. x 6 ft.	Good order.
1	"	16 in. x 14 in. x 3½ ft.	New.
1	"	22 in. x 20 in. x 5 ft.	"
1	"	24 in. x 24 in. x 6 ft.	Hendey. new
1	"	26 in. x 26 in. x 7 ft.	
1	"	20 in. x 20 in. x 4 ft.	Good order.
1	16 in. Upright Drill.		"
1	20 in. Upright Drill.		Prentiss. "
1	24 in.	"	Prentiss. "
1	30 in.	" "	" "
1	25 in. swing B.G. & S.F. Drill.		Blaisdell. "
1	28 in.	" " "	" " "
1	15 in. Shaper.	Gould & Eberhart.	"
1	15 in. Shaper.	Hendey.	"
1	24 in. Shaper,	Hendey.	"
1	9 in. Shaper	Hewes & Phillips.	
	Full assortment Milling Machines. Spindle Drills, &c., of Garvin's. New.		
1	Schlenker Bolt Cutter to take sizes from ¼ to 1¼ inches inclusive. New		
1	Twist Drill Grinding Machine.	Eddy. New.	
2	No. 2 Lincoln Millers.	Good order	
1	No. 2 Lincoln Miller.	New.	
1	Hand Lathe, 12 x 4, 5 and 6 ft.	New.	
1	Hand Lathe, 16 in. x 6 and 7 ft.	New.	
1	Upright Boring and Chucking Mill 31 in. swing. A1 order.		
1	Boring and Turning Mill, 50 in.	New.	
1	200 lb. Steam Hammer.	Ferris & Miles.	Good order

NEW YORK AGENCY OF THE TANITE CO., AND GRANT & BOGERT MACHINE TOOL WORKS.

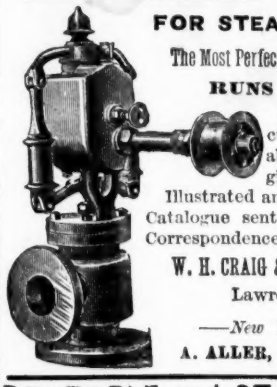
H. PRENTISS & COMPANY, 42 DEY ST., N. Y.

CRAIG'S HYDRAULIC GOVERNOR,

FOR STEAM ENGINES,

The Most Perfect Governor Known.

RUNS IN OIL.



Guaranteed to accurately regulate all classes of engines.

Illustrated and descriptive Catalogue sent on application. Correspondence solicited.

W. H. CRAIG & CO., Sole Manufr's,

Lawrence, Mass.

—*New York Agent*—

A. ALLEB, 109 Liberty St.

PORTABLE and STATIONARY

ENGINES

And BOILERS,

5 to 25 H. P. Parts duplicate and interchangeable, specially adapted to run Electric Light Machinery. Send for Circular.

SKINNER & WOOD, Erie, Pa.

Second-Hand & New MACHINERY.

Nov. 2, 1882.

The following New and Improved Machinists Tools are part of what we have for early delivery

1	60 in. swing	24 ft. bed.	Engine Lathe.	Dec	1.
1	42 in. "	20 ft. "	" "	"	1.
1	36 in. "	18 ft. "	" "	"	15.
1	36 in. "	14 ft. "	" "	"	15.

The following on hand:

1	30 in. Swing,	18 ft. bed.	New Engine Lathe.		
1	30 in. "	16 ft. "	" "	"	
1	30 in. "	14 ft. "	" "	"	
1	30 in. "	12½ ft. "			
1	26 in. swing,	14 ft. bed.			
1	32 in. x 8 ft.	Planers.	New.		
2	12 in. stroke Slotting Machines.	New. Oct. 10.			
1	42 in. swing,	16 ft. bed,	New Engine Lathe.		
1	New Corliss Engine.	12" x 36".	Complete.		
1	22 in. "	12 ft. "	"		
4	18 in. "	8 ft. "	"	"	
1	17 in. "	10 ft. "	"		
5	15 in. "	6 ft. "	"	"	
1	12 in. swing,	6 ft.	Hand Lathe. New.		
1	10 in. "	4½ ft.	Bed Hand Lathe. New.		
1	38 in. x 10 ft.	Planer.	New.		
1	38 in. x 12 ft.	Planer.	New.		
2	30 in. x 8 ft.	Planers.	New.		
2	22 in. x 4 ft.	Planer.	New.		
2	38 in.	Swing Upright Drills.	B. G. & S. F. New.		
1	23 in	Drill.	B. G. & S. F.	New.	
1	22 in. "	Upright Drill.	B. G. S. F.	New.	
1	23 in. "	Plain.			
3	20 in. "	"			
1	18 in.	Bench Drill.			
1	4 spindle	Drill.	New.		
1	3 "	"	"		
2	4 "	"	Second-hand.		
1	Wall Drill,	heavy.	Second-hand.	60 in	
2	12 in.	Shapers.	New.		
2	15 in. "	"			
2	12 in stroke Shapers, traveling head, 40 in. traverse double tables.		New.		
3	Wood's Patent Bolt Cutting Machines to cut from ½ in to 2 in inclusive.		New.		
1	Sellers Milling Machine.	2d-nand.			
1	Face Milling Machine.	Second-hand.			
1	Pond's Double Milling Machine.	2d-hand.			
1	No. 1 Screw Machine.	Brown & Sharpe.	2d-hand		
1	Screw Head Slotter.	Second-hand.			
2	Second-hand Profiling Machines				
2	4½ in	Hyde's Patent Centering Machines.	New.		
1	Emery Grinder,	2d-hand. for 10 in. Wheels.			
1	Bolt Pointing Machine.	Second-hand.			
1	Double Nut Tapper.	New Horizontal.			
2	Double-Acting Presses,	No. 3, nearly new.			
1	No. 00 Fowler Press.				
4	Single-Acting Presses,	10r power,	"		
100	Foot Presses,	nearly new.			
2	Small Power Punching Presses.	Second hand.			
1	Foot Punch,	with bench.	New.		
1	Lot Pistol Machinery.	Second-hand.			

Lot of Forges 1 Railway Saw Bench, 1 Foot-power Circular Saw.

Cold Rolled Shafting, Pulleys, Hangers, Couplings, &c., always in stock.

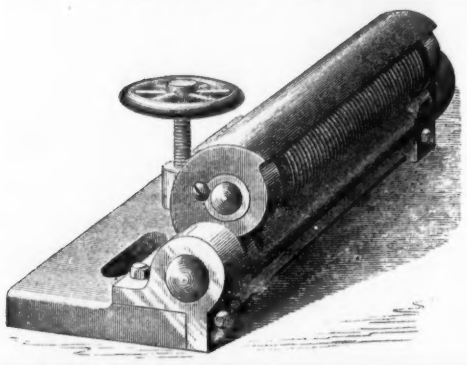
The George Place Machinery Company

121 Chambers and 103 Reade Sts., New York.

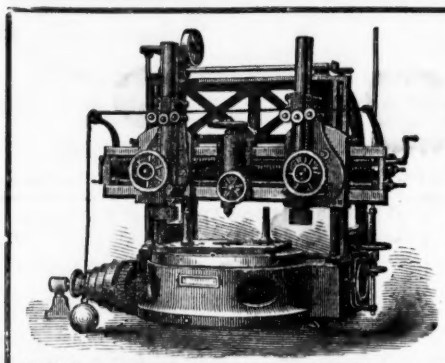
BROWN & SHARPE MFG. CO.

PROVIDENCE, R. I.

GRINDSTONE TRUING DEVICE.



One of the most disagreeable things to be done in a workshop is the Truing of Grindstones. It is, therefore, often the case that they are allowed to become quite out of shape and untrue, very much to the annoyance of the workman, who finds it almost impossible to grind his tools in a proper manner. The above cut illustrates a device which is well adapted for truing and keeping the face of grindstones constantly in good shape. This can be instantly applied to the face of the stone, working automatically, without interfering with the constant use of the stone, and does the truing without raising any dust.



Boring and Turning MILLS.

5, 6, 7, 8, 10, 12, 14 & 16 Feet Swing.

NEW PATTERNS.

Read the following Report of the performance of our Mill.

Salem, Col. Co., Ohio, Nov. 27, 1880.

We have just finished another pulley, 12'x27" face, weight 8860 lbs. Yesterday morning at 9 o'clock the rough casting lay on the floor by the mill and we commenced putting on the machine; got a cut started at 10.45 a.m.; finished the rim complete by 9.30 p.m., and got started on facing and boring the hub by 10 p. m.; started again at 7 a.m. this morning, and the pulley off at 11 a.m., 17 hours work all told, including handling on and off The casting was not a very true one and we chose to take three cuts over the face. Hub was 18" deep, with straight core, bored to gauge and chamber on the machine. Hub faced on one side. If you hear of better time let us know—only 10¾ hours on the rim of pulley. Truly yours,

JOEL SHARP, PREST. BUCKEYE ENGINE CO.

NILES TOOL WORKS, Hamilton, Ohio.

Eastern Warerooms, 22 S. Sixth Street, Philadelphia, Pa.

ELECTRIC LIGHT APPARATUS,

SPECIAL MACHINERY AND HARDWARE

Designed and built by day or contract. Have had five years experience building electric light apparatus. Facilities for making complete apparatus for 50 arc lights a day. Twenty years experience designing and building special and labor-saving machinery. Estimates given.

JAMES BRADY, (Suc'r to Brady Mf'g Co.)
257 & 259 Water St., Brooklyn, N. Y.

CRITCHLEY'S PATENT EXPANDING REAMER.

Manufactured by CRITCHLEY & WHALLEY,
Send for Circular. PORTSMOUTH, N. H.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.

J. M. ALLEN, PRESIDENT.
W. B. FRANKLIN, VICE-PRESIDENT.
J. B. PIERCE, SECRETARY.

GEO. W. FIFIELD,

MANUFACTURER OF

ENGINE LATHES

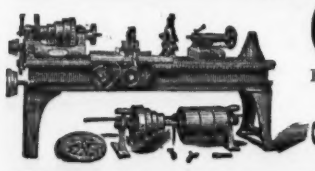
FROM 16 to 48 IN. SWING.

Cuts, Photographs and Prices furnished on application.

Lowell, Mass, U. S. A.

THE BUFFALO STEEL FOUNDRY, BUFFALO, N. Y.

PRATT & LETCHWORTH, Proprietors.
Orders and correspondence solicited.



GRAY'S PATENT 19 IN. LATHE.

Built to Standard Gauges and Templates, with Special Machinery.

EVERY MACHINE BELTED AND TESTED.

G. A. GRAY, Jr., & CO., 17 EAST 8TH STREET, CINCINNATI, O.

EXINUTILI TRADE TANITE MARK UTILITAS

Emery Wheels and Grinding Machines.

THE TANITE CO.

Stroudsburg, Monroe County, Pa.

Orders may be directed to us at any of the following addresses, at each of which we carry a stock:

NEW YORK, 42 DEY STREET.

Boston, High and Oliver Sts.
Philadelphia, 9 5 Market St.
Pittsburgh, 137 First Avenue.
Baltimore, 59 and 61 German St.
Indianapolis, 206 to 216 S. Illinois St.
Indianapolis, 184 & 186 E. Washington St.
Cincinnati, Cor. Pearl and Plum Sts.
Chicago, 152 & 154 Lake St.
Chicago, 40 Franklin St.
Minneapolis, 254 Second Avenue South.
St. Paul, 316 & 318 Robert St.
St. Louis, 209 N. Third St.
St. Louis, 811 to 819 N. Second St.
New Orleans, Union and St. Charles Sts.
San Francisco, 2 & 4 California St.
Portland, Oregon, 43 Front St.
Sidney, N. S. W., 17 Pitt St.
Liverpool, Eng., 42 The Temple, Dale St.

THE PRATT & WHITNEY CO., HARTFORD, CONN.

Have Ready for Delivery:

Drilling Machines—1, 42 in. table, automatic feed, back gears, quick return movement of spindle; No. 3 vertical, and No. 1 and No. 3 manufacturers; No. 0 gang drills, 3, 4 and 6 spindles; 1 14 in. Shaping Machine; 1 Horizontal Boring Mill, 14 ft. bed, 42 in. swing; 1, 10 in. Crank Shaper. Engine Lathes, 13 in. swing, 4, 5 and 6 ft. beds; 27 in. swing, 12 and 14 ft. beds; Hand Lathes, 12 in. swing, 4, 5 and 6 ft. beds; Cutting-off Lathes for 2½ and 4 in. diameter. Planers 20 in. x 20 in. x 5 ft.; Revolving head Screw Machines, No. 1, No. 2, No. 3 and No. 4; Hand Milling Machines, No. 1 and No. 2; Drop Hammers, 400 and 800 pounds; Bolt Cutters, turret head, No. 2, 3 and 4; National, No. 2, 3 and 4.

DROP FORGINGS

Of Every Description, from 1-16 ounce to 30 lbs. weight, for

Guns, Pistols, Sewing Machines, Machinists' Tools,

AND MACHINERY GENERALLY.

The Pioneers as a specialty in this line of business. Estimates given promptly on receipt of models Send for Catalogue and Descriptive Circular.

THE BILLINGS & SPENCER CO.

HARTFORD, CONN., U. S. A.

GRANT & BOGERT,

FLUSHING, L. I., N. Y.

MANUFACTURERS OF

FIRST-CLASS

MACHINE TOOLS.

E. E. GARVIN & CO.

139 & 141 Centre St., New York.

MANUFACTURERS OF

MACHINISTS' TOOLS,

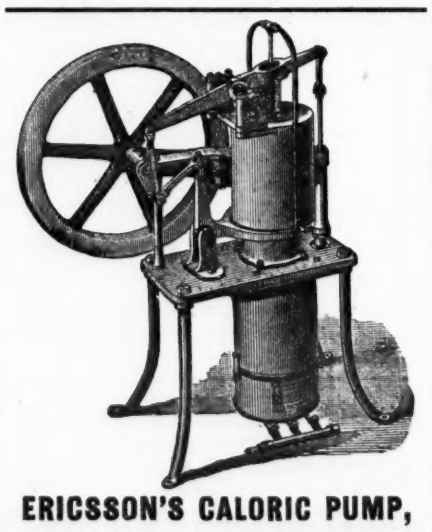
Milling Machines,
Drill Presses,
Hand Lathes,
Tapping Machines,
Cutter Grinders, &c.

SEND FOR NEW ILLUSTRATED CATALOGUE containing descriptions of the above machines.

ROP HAMMERS

Punching Presses
DIES AND OTHER TOOLS
For the manufacture of all kinds of SHEET METAL GOODS, DROP FORGINGS, &c.
Stiles & Parker Press Co., Middletown, Conn.

SPECIAL MACHINERY
Built to Order, and
TOOLS OF ALL KINDS,
Shop well furnished for good work.
S. Mc HENRY, 927 FILBERT STREET, PHILADELPHIA.



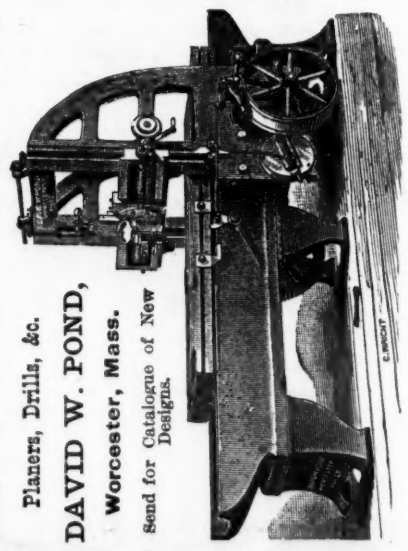
ERICSSON'S CALORIC PUMP,
C. H. DELAMATER & CO., 10 Cortlandt St., New York.

ENGINE LATHES,

Planers, Drills, &c.

DAVID W. POND,
Worcester, Mass.

Send for Catalogue of New Designs.



THE BABCOCK & WILCOX CO.'S

WATER TUBE STEAM BOILERS.

BRANCH OFFICES:
Boston, 50 Oliver St.
Syracuse, Room 15, White Buildings.
Philadelphia, 32 N. 5th St.
Pittsburgh, 91 4th Ave.

NEW YORK: 30 CORTLANDT ST.

GLASGOW: 107 HOPE ST.

BRANCH OFFICES:
Baltimore, Room 45, Chamber Commerce Building.
Chicago, 48 So. Canal St.
New Orleans 60 Carondelet
San Fra'co, 505 Mission St.

LODGE, BARKER & CO., CINCINNATI, OHIO,

Manufacturers of ENGINE AND TURRET LATHES.

We have for immediate delivery several Back Geared Turret Lathes, with dove-tail set over.
Also 18 inch Screw-Cutting Engine Lathes.

Quick delivery for 26 in. Swing Screw-Cutting Engine Lathes of new and improved designs. Very powerful and very convenient for handling.

MANUFACTURER OF TAPS & DIES